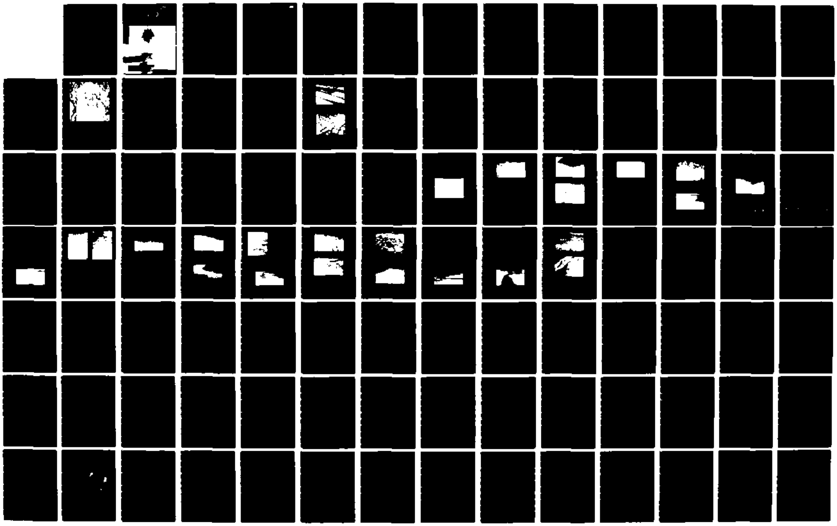
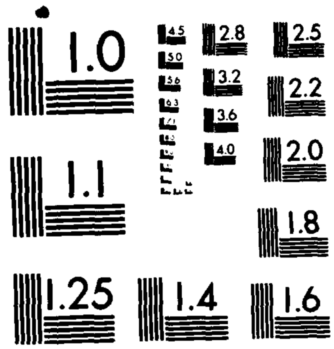
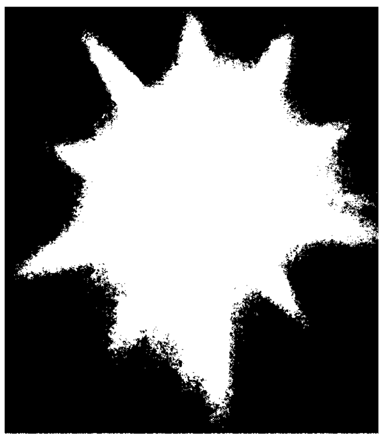
AD-A162 022 VEGETATION AND ENVIRONMENTAL GRADIENTS OF THE PRUDHOE BAY REGION ALASKA(U) COLD REGIONS RESEARCH AND ENGINEERING LAB HANOVER NH D A WALKER SEP 85 1/3

UNCLASSIFIED CRREL-85-14 F/G 6/3 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



For conversion of SI metric units to U.S./British customary units of measurement consult ASTM Standard E380, Metric Practice Guide, *published by the American Society for Testing and Materials, 1916 Race St., Philadelphia, Pa. 19103.*

Cover: Oriented thaw lakes near Prudhoe Bay. (Photo by D. Mills.)

CRREL Report 85-14

September 1985

Vegetation and environmental gradients of the Prudhoe Bay region, Alaska

Donald A. Walker

Unclassified
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CRREL Report 85-14	2. GOVT ACCESSION NO. AD-A162022	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) VEGETATION AND ENVIRONMENTAL GRADIENTS OF THE PRUDHOE BAY REGION, ALASKA		5. TYPE OF REPORT & PERIOD COVERED 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Donald A. Walker		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Institute of Arctic and Alpine Research University of Colorado Boulder, Colorado		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS DA Project 4A161102AT24, Task CS, Work Unit 001
11. CONTROLLING OFFICE NAME AND ADDRESS Office of the Chief of Engineers Washington, DC 20314		12. REPORT DATE September 1985 13. NUMBER OF PAGES 240
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) U.S. Army Cold Regions Research and Engineering Laboratory Hanover, New Hampshire 03755-1290		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution is unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Alaska	Prudhoe Bay
Arctic plants	Tundra
Environmental gradients	Vegetation
Plants (Botany)	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The Prudhoe Bay region is a particularly interesting area of tundra because of its well-defined and steep environmental gradients, the combination of which has not been described elsewhere in the Arctic. It is a region of wet coastal tundra that has a unique substrate pH gradient, due in part to its coastal location. The prevailing northeast winds distribute loess from the Sagavanirktok River over most of the region. Areas downwind from the river have alkaline tundra with a gradient of declining soil pH values away from the river; the northwest portion of the region is not downwind from the river and consequently has acidic tundra. The coastal temperature gradient is among the steepest in the Arctic. Three of Young's (1971) four floristic zones, which are based on the amount of total summer warmth, are present within the region. The effects of the temperature gradient can be seen in the increase of the total number of plants in

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

Unclassified
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

20. Abstract (cont'd).

the flora and the increased plant productivity, particularly of shrubs, as one moves inland. The predominantly wet landscape also creates steep vegetation gradients within elevation changes of a few centimeters. Small hummocks and higher microsites associated with ice wedge polygon relief may be elevated only 10–25 cm above the level of saturated soils but can support rich mesic tundra plant communities. Thus each point in the tundra of the Prudhoe Bay region is a product of numerous microscale, mesoscale and macroscale environmental gradients. This study examines these three scales of environmental gradients and their effects on the vegetation. Data from 92 permanent study plots are presented to document 42 vegetation types. Maps of the region (Walker et al. 1980) are analyzed to determine how the gradients affect the mapped vegetation and landform units. At the microscale, soil moisture, soil pH, percentage of organic matter, soil nutrients, snow depth, hummock size, cryoturbation and animal activity are examined. Pearson's correlation analysis is used to explore the relationships between variables and the cover data for each plant species. The mesoscale variables that are examined are all related to the loess gradient. The effects of loess on the soils and composition of the vegetation are studied using the same techniques as for the microscale variables. The macroscale portion of the study focuses on the effects of the steep coastal temperature gradient. A floristic analysis examines the flora with respect to the temperature, soil moisture and cryoturbation gradients. A willow study correlates summer warmth with the width of growth rings and the height of *Salix lanata* ssp. *richardsonii* along a 100-km north–south transect. A vegetation zonation of the coastal plain in the vicinity of the Sagavanirktok River based only on shrub height is also presented.

PREFACE

This report was prepared by Dr. Donald A. Walker, Research Associate, Institute of Arctic and Alpine Research (INSTAAR), University of Colorado, Boulder. It was written as a doctoral thesis prepared in 1981 at the University of Colorado, Department of Environmental, Population and Organismic Biology. The study was initiated in 1973 under the U.S. Tundra Biome portion of the International Biological Program (IBP) and is part of CRREL research activities conducted under DA Project 4A161102AT24, *Research in Snow, Ice and Frozen Ground,* Task CS, Work Unit 001, *Environmental Constraints on Frozen Terrain.* Portions of the field and office studies were undertaken with nonrestricted contributions to the University of Alaska's Tundra Biome Center from the Prudhoe Bay Environmental Subcommittee of the Alaska Oil and Gas Association. Other support was shared with Tundra Biome projects sponsored by the National Science Foundation, which were based at the Naval Arctic Research Laboratory at Barrow, Alaska. The report is a contribution to the U.S. IBP, the Man and the Biosphere Program, and the U.S.-U.S.S.R. bilateral Environmental Protection Agreement, Project V, *Protection of Northern Ecosystems* (Scriabine 1978).

Numerous individuals have made helpful suggestions. Dr. Roger Barry, climatologist at the Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, and Richard K. Haugen, CRREL, reviewed the climate sections. Mr. Haugen allowed the author to use his unpublished climate data from Prudhoe Bay and the Haul Road. Dr. Kaye R. Everett and Dr. John C.F. Tedrow reviewed the soils section. Dr. Vera Komárková, INSTAAR, reviewed the vegetation section. Individuals who participated in the field work included John Batty, John Davidson, Fred Rowley, Jane Westlye, Eleanor Werbe, Ken Bowman and Kate Palmer. Computer expertise came from Ken Bowman, John Albrecht, Kevin Dorr, Margaret Eccles, Kevin Bleeker and Steve Carnes. Drafting was done by Vicki Dow, Don Mills, Ken Bowman, Martha Bramhall and Eleanor Huke. Kate Salzburg of INSTAAR and Stephen Bowen of CRREL helped with numerous aspects of the technical illustrations.

Numerous taxonomists generously helped with the plant identifications. Dr. David Murray, University of Alaska Museum, and Dr. William Weber, University of Colorado Museum, examined the vascular plants. Dr. William Steere, New York Botanical Gardens; Barbara Murray, University of Alaska Museum; Dr. William Weber; Dr. Joanne Flock, University of Colorado; Dr. Sam Shushan, University of Colorado; and Dr. John Thomson, University of Wisconsin, all helped identify the mosses and lichens.

Most of the soils were analyzed at the INSTAAR sedimentology laboratory by Rolf Kihl. Dr. J. McKendrick, Agricultural Experiment Station, Palmer Research Center, University of Alaska, analyzed the soil nutrients. Tom Boldin, technician at the University of Colorado Medical School, sectioned and mounted the willow stems for the growth ring analysis.

Dr. Patrick J. Webber, University of Colorado, Department of Environmental, Population and Organismic Biology and Director of INSTAAR, was the thesis advisor and provided support through his contracts and grants. Dr. Everett, Institute of Polar Studies, The Ohio State University, and Dr. Jerry Brown, Earth Sciences Branch, CRREL, have been most helpful throughout this study and have been major sources of inspiration. Dr. Max E. Britton reviewed this work, and his comments are much appreciated. David Cate, CRREL, made numerous very helpful suggestions and has greatly helped the quality of this report.

CONTENTS

ILLUSTRATIONS

TABLES

Table Page

VEGETATION AND ENVIRONMENTAL GRADIENTS OF THE PRUDHOE BAY REGION, ALASKA

Donald A. Walker

CHAPTER 1. INTRODUCTION

The Prudhoe Bay oil field (Fig. 1) is in a region of nonglaciated wet coastal tundra with primarily alkaline soils. The recent extensive development (Fig. 2) has created a need for information regarding this relatively unknown type of tundra. The objective of this report is to provide a thorough description and analysis of the regional vegetation and environmental gradients.

Most of our knowledge of Alaskan arctic wet coastal ecosystems comes from Barrow, Alaska, which is an acidic tundra region. The early detailed ecosystem research at Barrow was, for the

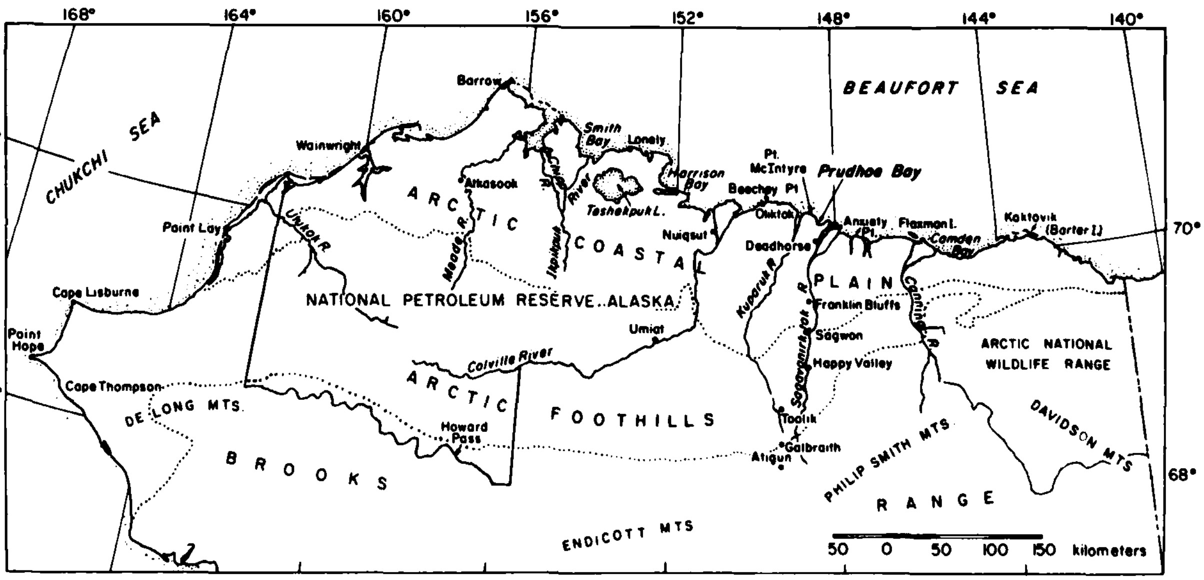


Figure 1. Location of Prudhoe Bay on the northern coast of Alaska. (From Walker et al. 1980.)

Figure 2. Road and pipeline network in the western (Sohio) portion of the Prudhoe Bay oil field. The roads connect numerous drilling pads, base camp, and construction and oil-processing facilities. Note the numerous oriented thaw lakes. (Photo by NASA.)

most part, confined to the immediate vicinity of the Naval Arctic Research Laboratory because of the difficulty of traveling inland. The Prudhoe Bay research had the advantage of easy access to a large diverse area of tundra due to the presence of the trans-Alaska pipeline haul road and the extensive road network within the region. This made feasible a detailed examination of the mesoscale and macroscale environmental and vegetation gradients along a continuous latitudinal transect. Cantlon (1961) was the first to discuss the vegetation of northern Alaska in terms of microscale, mesoscale and macroscale environmental gradients, and his precedent is followed here.*

* The microscale gradients are discussed first because the vegetation types are most easily defined in relation to microscale phenomena, and these types are discussed in the chapters on mesoscale and macroscale gradients. Some readers may prefer to read the chapters on mesoscale and macroscale gradients (Chapters 4 and 5) first, as this material may be of broader interest. This can be done with only occasional references to Chapter 3, particularly Table 3.

The microscale gradients are described in Chapter 3. Included here are descriptions of the major vegetation types and discussions of site moisture, snow depth and cryoturbation gradients. The primary emphasis is on soil moisture characteristics, their relationship to patterned-ground features, and the effects on other soil parameters. A major portion of the chapter is devoted to the responses of individual plant taxa to the various gradients. Chapter 4 considers the mesoscale gradients, primarily those related to loess deposited from the Sagavanirktok River. It includes discussion of the variation in soil parameters and species composition between study sites within the Prudhoe Bay region. Chapter 5 deals with macroscale patterns. It includes a floristic analysis, which examines the influence of the coastal temperature gradient on the regional flora. It also examines the importance of various worldwide floristic influences on the regional flora and how the relative proportion of the various elements changes along the temperature and soil moisture gradients. Chapter 5 also discusses the changes in shrub productivity along the temperature gradient by examining the variation in the height and growth ring widths of *Salix lanata* ssp. *richardsonii* along a 100-km transect from the coast to the arctic foothills.

This work was part of a multidisciplinary effort conducted by the International Biological Program (IBP) to examine the tundra biome (Brown 1975, Tieszen 1978, Brown et al. 1980, Walker et al. 1980), which built on an already substantial volume of research at Barrow (Britton 1973, Gunn 1973). This report is an edited version of a thesis prepared in 1981. Since it was written, there have been several new ecological studies related to environmental impacts within the oil field (e.g. U.S. Army Corps of Engineers 1980, 1982, LGL Alaska Research Associates 1983). There is also a new guidebook for the regional permafrost features (Rawlinson 1983) and a major new work on the paleoecology of Beringia (Hopkins et al. 1982). The rapid growth in knowledge of the region has dated some of the introductory material in Chapter 2, particularly the sections on geology and wildlife. Interested readers should consult the above references for more up-to-date discussions of these topics.

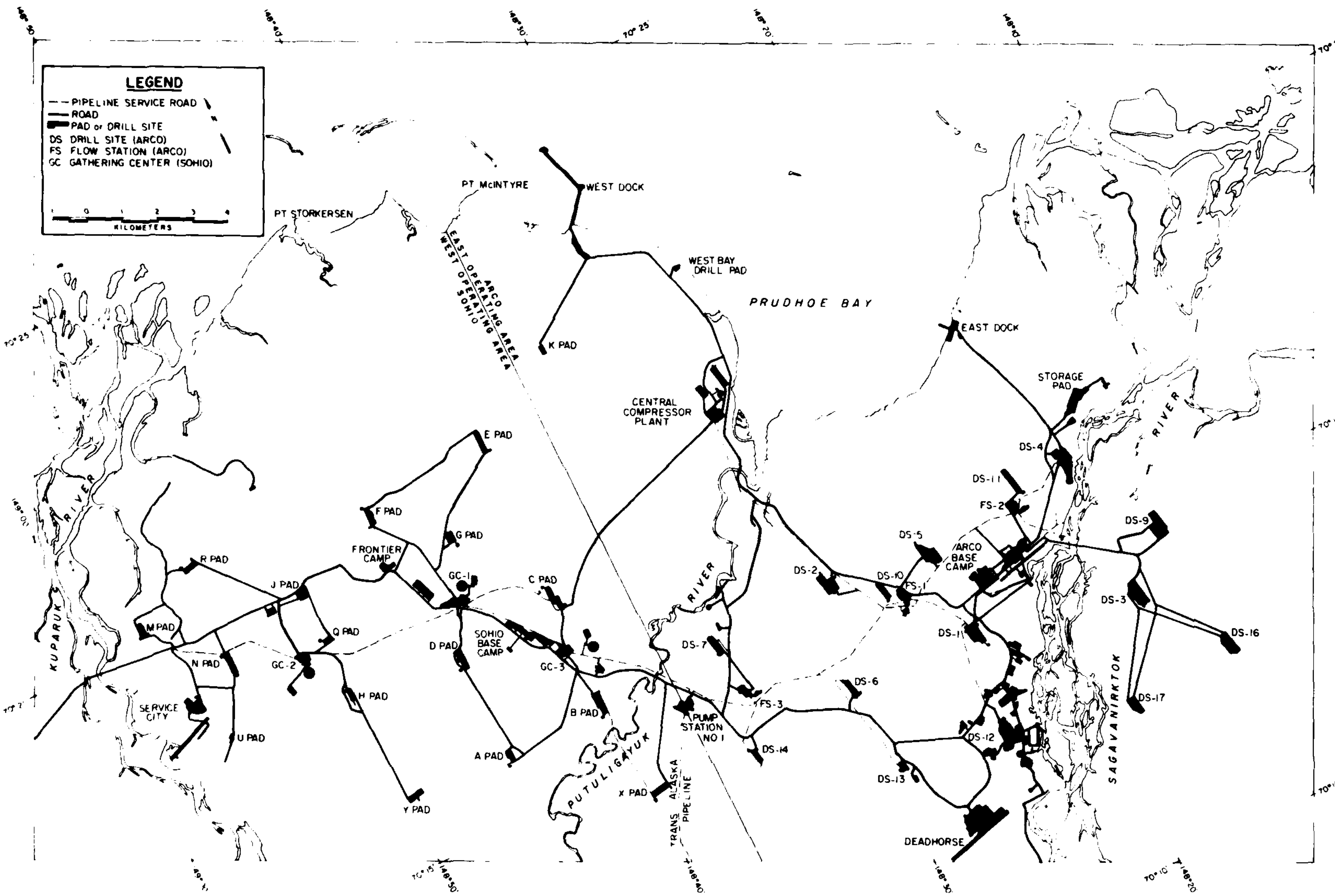


Figure 3. Map of the Prudhoe Bay region. (Adapted from Air Photo Tech Inc. 1979.)

CHAPTER 2. DESCRIPTION OF THE REGION

TOPOGRAPHY

The area discussed here is roughly defined by the extent of the road network as it existed in 1978 (Fig. 3). It lies between the Sagavanirktok River on the east and the Kuparuk River 25 km to the west and extends about 10 km inland to just south of the Deadhorse airfield. In 1979 the Kuparuk Field was connected to the Prudhoe Bay region by a road to the west. The Kuparuk Field is farther from the coast, and the vegetation is somewhat different from that in the main Prudhoe Bay region, mainly because the terrain is more rolling, the climate is relatively warm, and the tundra is acidic. The vegetation of the Kuparuk area was examined in 1980 but is discussed here only in comparison to the main Prudhoe Bay area.

Within the study area the terrain is mostly flat. From the air the dominant geomorphic characteristics are the numerous lakes and the polygonally patterned ground (Fig. 4 and 5). The lakes have a long-axis orientation of about N15°W, and they are "thaw lakes" in that they have been formed and enlarged by the thawing of frozen ground (Black and Barksdale 1949, Black 1969, Sellmann et al. 1975). Their elliptical shape and parallel alignment have been attributed to the action of wind (Carson and Hussey 1959, 1962, Rex 1961). The exact mechanisms for lake orientation are not, however, completely understood (Mackay 1963). The lakes are relatively short-lived phenomena that form, expand and drain within a few hundred to thousands of years. The process is cyclic, as new lakes form in the basins of drained lakes. These smaller lakes eventually enlarge until they too are drained, often by a stream that breaches the lake basin. The entire process is termed the "thaw lake cycle" and is described by Hopkins (1949), Britton (1967), Billings and Peterson (1980), Everett (1980d) and others.

Ice wedge polygons dominate the terrain between thaw lakes. The most widely accepted explanation for ice wedge polygon formation is Leffingwell's thermal contraction crack theory (Leffingwell 1915, 1919, Lachenbruch 1959, 1966). According to this theory, cracks form in the tundra when the surface contracts due to low winter temperatures. These cracks form a polygonal network similar in pattern to that formed in clays of dry lake basins, except the polygons are much larger, normally 5-40 m in diameter. In the spring, when there is unfrozen water on the tundra surface, water flows into the cracks. Below the permafrost table this water freezes, preventing the cracks from closing as the ground temperatures rise. Frost crystals, wind-blown snow and sand may also keep the cracks from closing. This process, repeated over many winters, eventually results in an ice wedge. Low-centered polygons are the most common ice wedge polygon form in the Prudhoe Bay region. Most are nonorthogonal, i.e. the ice wedges do not intersect at right angles. The polygon diameters range between 5 and 12 m (Everett 1980d). Each low-centered polygon is composed of three elements: a central basin, a raised peripheral rim and a trough. The rim consists of soil displaced by the ice wedge. The rims of adjacent polygons are separated by a trough that marks the position of the ice wedge. The actual ice wedge is usually only a few centimeters beneath the trough. Microrelief associated with low-centered polygons is commonly less than 0.5 m but can range up to 1 m (Everett 1980d).

High-centered polygons are another common feature. These form in two ways. Britton (1967) described one process that occurs in regions where there is rapid accumulation of peat, primarily *Sphagnum* peat. The peat forms in the polygon basins until the basin is converted to a raised polygon center. This process is common in acidic portions of the coastal plain, but it apparently does not occur in the alkaline tundra of the Prudhoe Bay region. Here most high-centered polygons form as a result of melting of the ice wedges, creating a deeper trough and a relatively elevated polygon center. This commonly occurs in areas

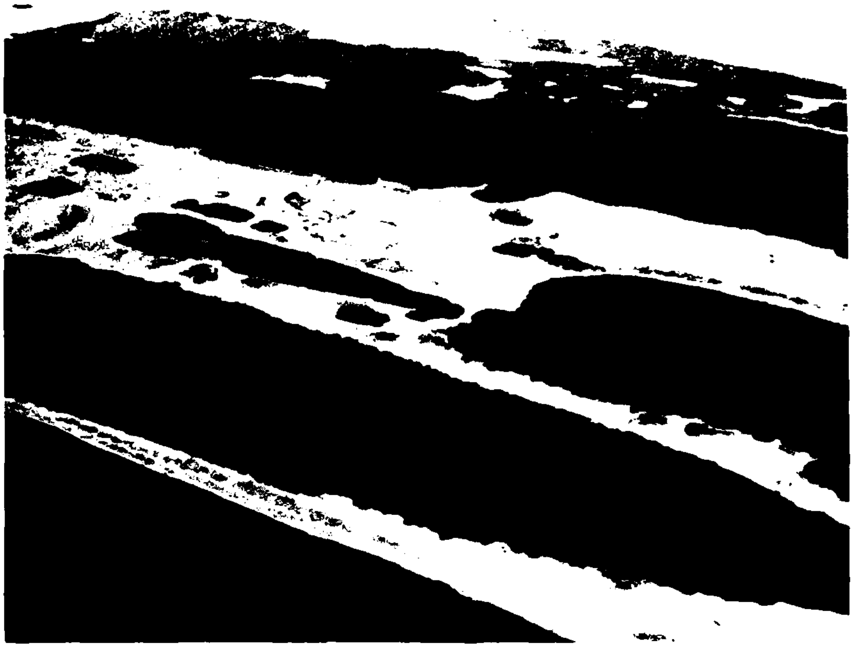


Figure 4. Oriented thaw lakes in the Prudhoe Bay region.

Figure 5. Low-centered polygons in the delta of the Kuparuk River.

where the local drainage has been improved, either by the formation or drainage of a thaw lake or by the proximity to a stream or river that has a steep drainage gradient along its margin. High-centered polygons also occur along roads where ponding, thermokarst and settling of the road have changed the local hydrologic regime.

Polygons of one form or the other, sometimes with low- and high-centered forms mixed together in complex systems, cover most of the Prudhoe Bay landscape. Although the region is generally flat, on a microscale the surface is actually quite rough. Microrelief variations of less than 0.5 m associated with ice wedge polygons are responsible for most of the spatial variation in soil and vegetation type within the area.

Other landform types associated with flat surfaces include nonpatterned ground, disjunct polygon rims, reticulate-patterned ground, frost scar terrain and hummocks (Everett 1980d). Nonpatterned ground and disjunct polygon rims are commonly associated with new surfaces in recently drained lake basins. Reticulate-patterned ground occurs on well-drained upland surfaces, often near streams. The pattern is a complex arrangement of slightly convex polygons with diameters less than 1 m (Everett 1980d). Frost scars, or nonsorted circles, are another form of patterned ground. The circles are 1-2 m in diameter with a center spacing on the order of 2.5 m (Everett 1980d). The central areas of the frost scars are often barren and frost active. Washburn (1969) has described the processes involved in frost scar formation. The sloping terrain associated with pingos and streams is commonly very frost active, with small frost scars and/or large earth hummocks. The hummocks can be up to 0.2 m tall and 0.5 m in diameter (Everett 1980d).

Pingos are the most distinctive features in the region. These small, dome-shaped hills are products of cryostatic forces that occur with the development of permafrost in recently drained lake basins (Porsild 1938, Mackay 1962, 1979, Everett 1980d).

Several streams and rivers give the landscape further variety. The Sagavanirktok and Kuparuk rivers have numerous braided channels with extensive gravel and sand bars. Active sand dunes occur in the deltas of both rivers and are extensive along the western bank of the Sagavanirktok. Bluffs and terraces associated with the rivers provide sufficient terrain relief so that snowbanks last into late July. The Putuligayuk and Little Putuligayuk are smaller rivers and have oxbow lakes and beaded thaw ponds. The extensive, barren gravel bars in the larger rivers are due to the high spring runoff levels that occur within ten days following breakup. Up to 90% of the annual flow can occur within this period on the Little Putuligayuk River (Carlson et al. 1977). During midsummer and late summer, flow rates are much reduced, exposing the river bars.

Murray (1978) has noted that the large gravel-bottomed rivers in the region are the main features that make the Prudhoe Bay area so different from the IBP study site at Barrow and the coastal plain west of the Kuparuk River. The rivers west of the Kuparuk and east of the Utukok River near Icy Cape all either drain into the Colville River or have their headwaters in the unconsolidated deposits of the coastal plain or in the foothills associated with Lookout Ridge. The Kuparuk, Sagavanirktok, Shaviovik, Canning, Hulahula, Okpilak and rivers to the east all have their headwaters in bedrock areas of the Brooks Range.

The Sagavanirktok River is responsible for the calcareous substrate in the Prudhoe Bay region and along the river to the south (Drew 1957, Koranda 1960, O'Sullivan 1961, Murray 1978, Parkinson 1978, Steere 1978). The river and many of its tributaries pass through the Lisburne limestone deposits on the northern flank of the Brooks Range. The calcareous silts are spread from the broad river channels to the surrounding terrain by strong easterly winds (Benson et al. 1975, Walker and Webber 1979b).

The seacoast is another distinct and interesting area, with coastal bluffs, driftwood-littered strand lines, sand beaches, saltwater lagoons and estuaries. Numerous barrier islands occur offshore.

The morphology of the North Slope in general has been reviewed by H.J. Walker (1973). The periglacial landforms in the Prudhoe Bay region, excluding those at the coast, have been described and mapped at a scale of 1:12,000 by Everett (1980d). The hydrology of the region has been discussed by Bilgin (1975), Carlson et al. (1977) and Updike and Howland (1979).

GEOLOGY

The oil and gas is contained in Sadlerochit sandstones at a depth of about 3000–3300 m. Oil has also been found in the Kuparuk, Sagavanirktok, Shublik and Lisburne formations (Fig.6). The oil-bearing formations lie along the Barrow Arch, which runs parallel to the northern Alaskan coast-

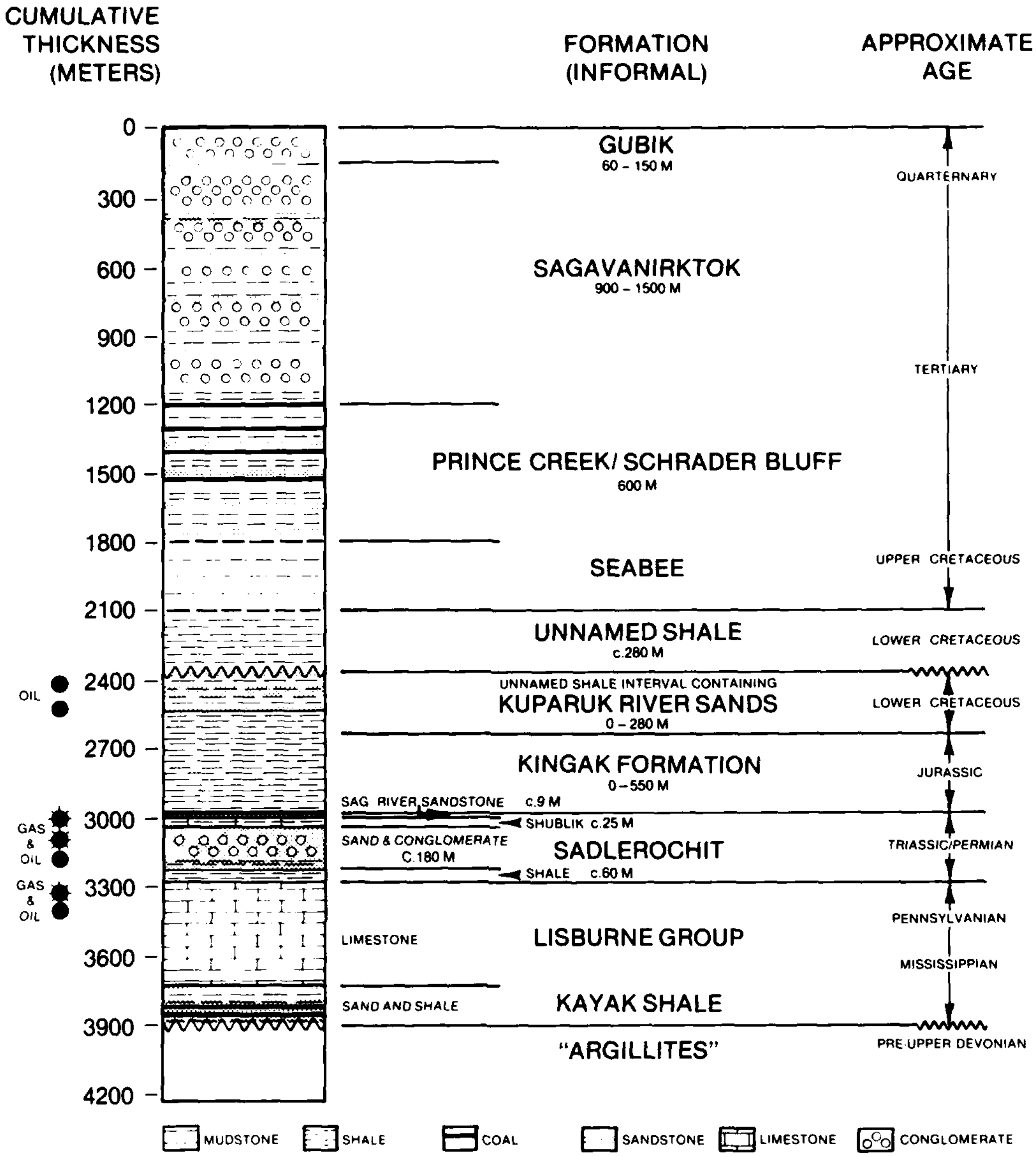


Figure 6. Generalized stratigraphic profile of the Prudhoe Bay region. (Adapted from BP Alaska 1971.)

line. The hydrocarbons are trapped in the Prudhoe Bay field by truncation of the Sadlerochit formation by Lower Cretaceous shales east of the Sagavanirktok River and by faults on the north and southwest sides. The area of closure on the top of the Sadlerochit formation, forming the main Prudhoe Bay oil pool, is about 500 km^2. Details of the structure of the field and the geologic history are contained in Rickwood (1970) and Morgridge and Smith (1972). The Lower Cretaceous shales and Upper Cretaceous mudstones, shales and sandstones above the oil-bearing rocks have been given informal designations as shown in Figure 6. The deep conglomerates, mudstones and sandstones of the Sagavanirktok formation are products of deposition in a shallow sea that covered much of northcentral Alaska during the Tertiary period (Morgridge and Smith 1972).

The stratigraphic column is topped by up to 150 m of unconsolidated Quaternary gravel deposits (BP Alaska, Inc. 1971) termed the Gubik formation (Smith and Mertie 1930, O'Sullivan 1961, Black 1964). O'Sullivan described the Quaternary deposits of the coastal plain and contrasted the

deposits in the Kuparuk-Sagavanirktok region with those to the west. Much of the Gubik sediment was formed in a marine environment, but there is intermixing with fluvial and eolian deposits (O'Sullivan 1961, Black 1964). Everett (1980c) considered the Quaternary deposits in the Prudhoe Bay region to be reworked Tertiary sediments of materials derived from the Brooks Range. Much of the surface is mantled with about 1 m of loess and surface organic deposits (Everett 1980c).

The surface geology of the Prudhoe Bay region has been mapped by Updike and Howland (1979). The region has not been glaciated. Most of the surface is dominated by lacustrine silt and gravel deposits associated with lakes in various phases of the thaw lake cycle. Large areas are also covered by fluvial deposits associated with the active and inactive channels of the Sagavanirktok, Kuparuk and Putuligayuk rivers. The northeastern portion of the region has eolian deposits associated with the Sagavanirktok River dunes. Some areas immediately adjacent to the coast are mantled by the Flaxman formation, a marine sandy mud containing some fairly large boulders (Leffingwell 1919, O'Sullivan 1961). The boulders were apparently ice-rafted from a Canadian glacial source (MacCarthy 1958, Hopkins et al. 1978, Rodeick 1979).

The history of the sea level in the region for the past 30,000 years has been presented by Hopkins (1977) and Sellmann and Brown (1973). During the last glaciation the sea level retreated north of its present location. For the Chukchi Sea on the Seward Peninsula, Hopkins (1977) showed that the sea level was at -27 m 30,000 years ago, retreated to about -90 m by 18,000 years ago, and then rose to near the present level by 5,000 years ago. After the ocean retreated, permafrost began developing on the exposed coastal plain surfaces. With the readvance of the ocean following the Itkillik glaciation in the Brooks Range (Hamilton and Porter 1975), many permafrost areas were covered with water, and some of these offshore areas today contain subsea permafrost (Lachenbruch and Marshall 1977, Barnes and Hopkins 1978, Vigdorchik 1978, 1980b). The sea level history prior to the Wisconsin glaciation is much more sketchy. Several authors (Hopkins 1977, O'Sullivan 1961, McCulloch 1967) have recognized terraces in western Alaska that represent interglacial warm periods that correspond to the history of sea level worldwide.

Coastal erosion rates in the Prudhoe Bay region are on the order of 1 m per year, which is relatively low compared to other segments of the Beaufort coast (Harper 1978, Hopkins and Hartz 1978a, b). This is due to the sandy beaches along the Prudhoe Bay coast, which are more stable than the silty, peaty bluffs that are common for long stretches of the coastline to the west. O'Sullivan (1961) and Vigdorchik (1980a) suggested that the lower erosion rates may also be due to greater tectonic uplift in the eastern portion of the coastal plain.

Howitt (1971) has discussed onshore permafrost in the Prudhoe Bay region and some of the related engineering problems. The depth of permafrost in the region is about 660 m, the deepest known in Alaska (Gold and Lachenbruch 1973). Near the surface the permafrost is particularly ice rich. The top 3–4 m of permafrost may contain up to 80% interstitial ice, not counting massive ice associated with ice wedges (Brown and Sellmann 1973). Everett (1980d) has mapped the top 2.5 m of permafrost along a 170-m-long trench at the Gas Arctic gas pipeline test facility at Prudhoe Bay. His maps dramatically show the large amounts of massive ice wedge and interstitial ice.

CLIMATE

The Prudhoe Bay climate is characterized by long, cold winters and short, cool summers and falls. The annual mean temperature is about -13 °C, with the July mean ranging from about 4 °C at the coast to about 8 °C at some inland areas (Table 1). This places the Prudhoe Bay region well within the arctic climate zone as defined by Köppen (1936).

During the winter the sun is below the horizon for 49 consecutive days, and the mean monthly temperatures remain below 0 °C from September through May. The monthly means for January, February and March are around -30 °C, and persistent winds sometimes produce chill factors of less than -110 °C (Gavin 1973). Winter wind data for 1974-75 for Prudhoe Bay have been summarized by Gamara and Nunes (1976). During that period (October to March) wind velocities exceeded 13 km h^{-1} 73% of the time and exceeded 39 km h^{-1} 8% of the time. During November, December, January, February and April, winds were from the west or west-southwest 44% of the time. Schwerdtfeger (1973) explained that at Barter Island the strong winter westerlies are products of cold, stable air flowing from the north and piling up against the barrier of the Brooks Range, resulting in a west wind parallel to the range. It appears that this effect extends as far west as Prudhoe Bay.

Winter precipitation is generally light. Clear to partly cloudy skies are present more than 60% of

Table 1. Summary of available climatic data (temperature, precipitation and wind) for Prudhoe Bay, Alaska (1970–1978).

a. TEMPERATURE[1]

Location	Temperature (°C) J	F	M	A	M	J	J	A	S	O	N	D	Annual	Thaw degree-days	Distance from coast (km) Shortest	Along wind vector
Arco 8-yr mean (1970–1978)	-28.2	-31.5	-29.6	-19.4	- 5.9	3.0	6.7	6.0	0.3	-11.9	-20.5	-27.5	-13.0			
West Dock															0.7	0.7
1976						1.7	4.1	4.2	0.3					287		
1977						- 1.5	2.6	4.2	1.6	- 3.1				318		
Pad F															7.1	7.1
1976							5.4	4.1	1.1							
1977						4.0	4.2	6.2	1.7	- 4.0				491		
Arco															6.0	20.8
1976	-30.8	-31.9	-29.0	-16.5	- 5.9	3.2	6.8	6.6	1.7	-11.4	-16.5	-30.4	-12.8	571		
1977	-23.1	-28.0	-31.9	-19.1	- 5.5	3.7	5.5	8.2	2.5	- 4.7	-21.4	-23.4	-11.4	613		
1978		-26.0	-24.6	-16.5	- 7.6	2.8	8.4	5.2	2.6	-12.9	-14.8	-23.3	-10.6[2]	606		
Deadhorse															11.8	26.2
1976					- 1.9	4.3	7.3	5.8	1.4					556		
1977					- 1.2	5.7	7.6	9.8	5.8	- 6.0				879		

b. PRECIPITATION[3]

Date	Duration of thaw season	Unfrozen precip. (mm)	Snow water (mm)	Total thawed precip. (mm)
1977	31 May-6 Oct	101	165	266
1978	5 Jun-29 Sep	83	95[4]	178

c. WIND

Mean speed (km/hr) / Principal direction(s) (% of winds from this octant)

Location	J	F	M	A	M	J	J	A	S	O	N	D
Pad F[5]												
1974						> 32.2 NE-E(45) W-NW(30)	16.4 NE-E(45)	> 23.0 NE-E(70)	> 30.2 E-SE(73)	> 21.8 NE-E(62)	18.7 SW-W(53) NE-E(24)	14.2 SW-W(58) NE-E(21)
1975	> 22.0 SW-W(57) NE-E(28)	> 21.3 NE-E(42) SW-W(41)	15.5 E-SE(31) SW-W(20)	13.6 W-NW(43) E-SE(17)	> 25.7 NE-E(68)							
Gas Arctic site[6]												
1977[7]							17.5 NE-E(42)	13.0 E-SE(51)				
1978						15.7 NE-E(54) N-NE(28)	17.2 NE-E(39) N-NE(38)	13.7 E-SE(27)				

[1] Haugen (1979) and Walker et al. (1980).
[2] January missing.
[3] Haugen (1979), IBP site (Wyoming snow gauge).
[4] Gauge bridged over by snow.
[5] Gamara and Nunes (1976); speed data derived from the following classes: calm, 1-3, 4-6, 7-10, 11-16, 17-21, > 21 knots, directions derived from 20° interval wind roses.
[6] Everett (1980b); speed data derived from the following classes: 0-1, 1-2, 2-3, 3-4, 4-5, 5-6, 6-7, 7-8, 9-10 m/s, directions derived from 15° interval wind roses.
[7] Periods of record for 1977 are 28 June-23 July, 24 July-24 August.

the time (Brower et al. 1977). The clear weather is due to the dominance of high pressure systems and the presence of a deep thermal inversion (Conover 1960). The average April snowpack is on the order of 30–40 cm thick. The snow surface is generally high-density windpack (to 480 kg m^{-3}),* with up to 20 cm of low-density depth hoar at the base of the snowpack. The snow surface is rough, with snow dunes and sastrugi.

In summer the region can be divided into two fairly distinct climatic areas. The immediate coastal area has a climate similar to Barrow's. Inland areas have a somewhat modified arctic coastal climatic regime (Dingman et al. 1980). Along the coast there is more fog, less sunshine, and lower temperatures than at stations only a few kilometers inland. The very steep temperature gradient at the Prudhoe Bay coast has been described by Haugen (1979) and Walker and Webber (1979b). Within the region temperatures are closely correlated with the distance to the coast measured in the direction of the primary wind vector, N75°E. Conover (1960) has described the Arctic Front and its influence on seasonal temperatures.

On days when high temperatures prevail inland, a cold sea breeze is often present at the coast (Moritz 1977). However, during fall (September and October) the coastal areas are relatively warm compared to inland areas (Table 1) because of the moderating influence of the open Beaufort Sea. Once the ocean freezes (usually in October), the temperature contrast between the coast and inland areas is minimal.

Summer winds have been recorded by Gamara and Nunes (1976) and Everett (1980b). Gamara and Nunes' data show a preponderance of winds from the east and east-northeast for the summer of 1975; this is normal. Everett's data show a large proportion of winds from the south and west in 1977. Temperatures in 1975 were about average, whereas 1977 was much warmer than normal. Rogers (1978) explained the summer wind patterns by contrasting pressure conditions north of Prudhoe Bay with those over the East Siberian Sea. Offshore winds and higher temperatures are associated with high barometric pressure northeast of Alaska and low pressure to the west. Onshore winds and low temperatures are associated with the reverse situation. The wind conditions are also important with respect to sea ice. Heavy summer ice is correlated with a preponderance of onshore winds (Rogers 1978). Shapiro and Barry (1978) indicated that the severity of late summer ice conditions can be forecast in early summer on the basis of accumulated thaw degree-days.

Summer precipitation is frequent, but amounts are small. Fog and drizzle are the most common forms of summer moisture. Annual precipitation for the region has been calculated to be about 160 mm, based on stream runoff records and summer evaporation rates (Kane and Carlson 1973, Dingman et al. 1979).

Further details of the Prudhoe Bay climate are given by Gavin (1973), Brown et al. (1975) and Walker (1980). Also see Conover (1960), McKay et al. (1969), Searby and Hunter (1971), Haugen (1979, 1980), Moritz (1979), Dingman et al. (1980) and Haugen and Brown (1980) for information regarding North Slope climate and microclimate. The synoptic weather patterns for the Beaufort Sea region have been described and analyzed by Moritz (1979).

SOILS

The soils of the Prudhoe Bay region are described in detail by Everett and Parkinson (Everett 1975, 1980e, Everett and Parkinson 1977, Parkinson 1978). The soil names are based on the taxonomic methods of the U.S. Department of Agriculture Soil Conservation Service (Soil Survey Staff 1975). Soil nutrient regimes of the Prudhoe Bay soils are described by Douglas and Bilgin (1975) and Bilgin (1975).

Of the ten soil orders occurring in the United States, four are represented in the Prudhoe region. These are the Entisols, Mollisols, Inceptisols and Histosols (Table 2).

The order Entisols includes mineral soils that show little or no soil development and are common on unstable sites such as sand dunes and active alluvial flood plains. Within the region, Pergelic Cryopsamments and Pergelic Cryorthents are representative Entisols. The first occurs in dune areas, and the second occurs as recent alluvial material along the Sagavanirktok and Kuparuk rivers.

Mollisols are dark, base-rich soils commonly associated with the grasslands of the Great Plains. In arctic regions Mollisols form on well-drained alkaline sites as a result of the oxidation of mineral-rich peat (Everett and Parkinson 1977). Two Mollisols occur in the Prudhoe Bay region, Pergelic Cryoborolls and Pergelic Cryaquolls.

* Personal communication with K. Everett, The Ohio State University.

Table 2. Soils of the Prudhoe Bay region, Alaska.

*Taxonomic name**	*Mapping code**	*Identifying field characteristics*	*Approximate Tedrow equivalent†*	*Approximate Canadian equivalent***	*Typical microsite*
Mollisols					
Pergelic Cryoboroll	1	A cold more or less freely drained soil, underlain by permafrost, with a dark, humus-rich, granular-textured surface horizon ≥ 18 cm thick; free carbonates throughout.	Rendzina	Brunisolic Static Cryosol (subhumid to semiarid soil climate at family level).	Pingos, well-drained hummocky terrain, high-centered polygons, ridges.
Pergelic Cryaquoll	2	A cold, dark-colored, wet soil, prominantly mottled in the lower part of the humus-rich, weakly granular surface horizon.	Upland Tundra	Brunisolic Static Cryosol (aquic soil climate at family level).	Less well-drained high-centered polygons, reticulate-patterned terrain.
Pergelic-Ruptic-Aqueptic Cryaquoll	6	The cold soil of frost scar areas in which a Cryaquoll soil (above) is intimately associated with and interrupted by a cold, wet, gray-colored and mottled mineral soil lacking any significant organic surface horizon, i.e. a Pergelic Cryaquept.	Upland Tundra and Meadow Tundra	Brunisolic Turbic Cryosol (aquic soil climate at family level).	Frost scar terrain
Inceptisols					
Pergelic Cryaquept		A cold, wet, gray and mottled mineral soil with no or only a shallow (< 25 cm thick) organic surface horizon.	Meadow Tundra	Gleysolic Static Cryosol	Wet sites with little accumulation of organic materials; wide variety of sites, including frost scars, flood plains, drained lake basins.
Histic Pergelic Cryaquept	3(1) 4(1)	A cold, wet, gray mineral soil, commonly mottled, having a surface horizon ≥ 25 cm thick, composed of predominantly organic (peaty) material.	Wet Meadow Tundra or Half Bog	Terric Organic Cryosols (includes Terric Humic Organic Cryosol, and Terric Mesic Organic Cryosol).	Wet to very wet sites with moderate accumulation of organic materials; wide variety of wet microsites. Many otherwise organic soils that have been diluted with loess materials are classified here.
Histosols					
Pergelic Cryosaprist	3(3)	A cold, wet, dark-colored soil composed of completely decomposed organic material to depths > 40 cm.	Bog	Humic Organic Cryosol	Moist sites with deep organic materials (e.g. polygon rims, some polygon centers, strangmoor hummocks).
Pergelic Cryohemist	3(2)	A cold, wet, dark-colored soil composed of moderately decomposed organic material to depths > 40 cm.	Bog	Mesic Organic Cryosol	Wet sites with deep organic materials (e.g. wet low-centered polygon centers and troughs). The most common organic soil of the region.
Pergelic Cryofibrist	4(2)	A cold, wet, reddish-yellowish soil composed of little decomposed fibrous organic material to depths > 40 cm.	Bog	Fibric Organic Cryosol	Very wet sites with deep organic materials (e.g. wet low-centered polygon centers, partially drained lake basins).
Entisols					
Pergelic Cryorthent	5	A cold, somewhat freely drained, gravelly soil, lacking significant horizon development and generally free of organic material.	Alluvial	Regosolic Static Cryosol (fragmental particle size at family level)	River alluvium.
Pergelic Cryopsamment		A cold, dark grayish brown more or less freely drained, sandy soil, lacking significant horizon development and generally free of organic material.	Regosol	Regosolic Static Cryosol (sandy particle size at family level).	Sand dunes.

* Everett (1980e) after Soil Survey Staff (1975).
† Tedrow (1977).
** Canada Soil Survey Committee (1978).

Cryoborolls occur only on the best-drained sites, such as pingos and some areas of old high-centered polygons. Everett (1980e) considers the Cryoboroll to be the zonal soil for the region. It is the base-rich analog of the Arctic Brown soil (Pergelic Cryumbrepts/Pergelic Cryochrepts) described by Drew and Tedrow (1957) in the Barrow area. Pergelic Cryaquolls occur in somewhat less well drained sites, such as interfluves with slightly convex polygons. In many instances Cryaquoll profiles are highly contorted due to frost stirring, which may or may not be expressed at the surface in the form of frost scars. Such soils are termed Pergelic Ruptic Aqueptic Cryaquolls (Everett and Parkinson 1977).

Inceptisols are mineral soils with altered horizons that have lost the bases, iron or aluminum but retain other weatherable minerals (Soil Survey Staff 1975). At Prudhoe Bay these soils are common in poorly drained sites. The main Inceptisols are Pergelic Cryaquepts, which cover broad areas of the region. They are characterized by a surface peaty layer that may vary in its state of decomposition. If the peaty layer exceeds 25 cm, the term Histic, which implies a thick organic surface horizon, is added to the name. Histic Pergelic Cryaquepts are probably the most common soil in the region.

Histosols are deep organic soils where more than half of the upper 80 cm consists of organic matter. At Prudhoe Bay these soils are difficult to distinguish from Histic Pergelic Cryaquepts, since they often require an examination of materials below the permafrost table. Three Histosols are recognized in the Prudhoe Bay region. They are distinguished by the degree of decomposition of the organic materials. Pergelic Cryofibrists are the least decomposed, with coarse, fibrous peat that is easily identified as to botanic origin. Pergelic Cryohemists are composed of coarse but mostly unidentifiable plant remains, and Pergelic Cryosaprists are almost completely decomposed, with bulk densities exceeding 0.2 g cm^{-3} (Soil Survey Staff 1975). These three Histosols, in combination with Histic Pergelic Cryaquepts, are the primary soils occurring in most low-centered polygon complexes and marshy areas. Parkinson (1978) discussed the soils in relation to the major landforms, and Everett (1980e) discussed their relation to the thaw lake cycle and the evolution of the coastal plain landscape.

Parkinson (1978) discussed some of the problems that the regional and coastal plain soils in general represent to the soil taxonomist. Three problems are of particular importance at Prudhoe Bay: 1) how to describe soils in patterned ground complexes where the sizes of polygonal features exceed 10 m^2, which is the current maximum size of a pedon according to the USDA methods; 2) how to deal with the permafrost table when taxonomic criteria often require the examination of materials at depths of up to 80 cm (the depth of the active layer at Prudhoe Bay rarely exceeds 45 cm); and 3) how to deal with mineral dilution by loess materials in soils that are obviously organic in terms of the volume of organic materials but fail to qualify as organic soils on the basis of weight, the criterion currently used in the taxonomic system. While recognizing the difficulties of the taxonomic system, Everett has classified and mapped the soils of Prudhoe Bay (Everett 1980e), Barrow (Brown et al. 1980b) and Atkasook (Everett 1979) according to the USDA framework.

Another widely used approach to soil classification in the Alaskan Arctic is that of Tedrow (Tedrow et al. 1958, Tedrow and Cantlon 1958, Brown 1966, Rickart and Tedrow 1967, Tedrow 1977). In Tedrow's Tundra Zone, which covers all the coastal plain of northern Alaska, he recognizes three major groups of soils: Arctic Brown, Tundra, and Bog soils. The Arctic Brown soil is characteristic of well-drained sites. The Cryoboroll soil occurring on dry sites at Prudhoe Bay corresponds to the Rendzina soil described from carbonate-rich areas in the Brooks Range (Ugolini and Tedrow 1963). Tundra soils are mineral gley soils topped by an organic mat. Two phases are recognized, Upland Tundra soil and Meadow Tundra soil. The Upland Tundra soil corresponds approximately to the Pergelic Cryaquoll soil at Prudhoe Bay. The Meadow Tundra soil is approximately equivalent to the Pergelic Cryaquepts and Histic Pergelic Cryaquepts. Tedrow's Bog soil corresponds to the Histosols (Pergelic Cryosaprists, Pergelic Cryohemists and Pergelic Cryofibrists), and his Half Bog soil corresponds approximately to the Histic Pergelic Cryaquept.

The problems inherent in arctic soil classification and nomenclature are difficult to resolve, especially in view of other national systems (e.g. the Canadian [Canada Soil Survey Committee 1978] and Soviet [Ivanova 1956] systems). Tedrow (1977) discussed these problems, along with his own proposal for a classification system applicable to all polar regions. Table 2 presents the approximate equivalents of the Prudhoe Bay soils in the Canadian and Tedrow systems.

WILDLIFE

The fauna of the region reflects the coastal location in that there are large numbers of shorebirds, waterfowl and caribou. These animals are concentrated near the coast partly because many species find their food in the nearby marine environment and partly because the lower summer temperatures near the coast offer relief from the maddening swarms of mosquitoes found inland. The mammalian fauna of the Prudhoe Bay region is considerably different from that of the other well-known Alaskan arctic coastal site at Barrow. Caribou (*Rangifer tarandus granti*) and arctic ground squirrels (*Spermophilus parryi*) are common at Prudhoe Bay, and brown lemmings (*Lemmus sibericus*) are apparently rare. At Barrow the situation is reversed; caribou and ground squirrels are infrequent due to hunting pressure from the Barrow village, and the brown lemming is the only common grazer. Bee and Hall (1956) listed 29 species of terrestrial mammals occurring on the Arctic Slope. Fourteen of these have been recorded within the Prudhoe Bay region and another five could occur.

Caribou

Prudhoe Bay lies on the boundary between the summer ranges of the Porcupine caribou herd to the east and the Arctic herd to the west (Skoog 1968). Both of these herds are now smaller than normal due to a major population decline in the mid-1970s (Gavin 1980). Most of the animals currently visiting the Prudhoe Bay area are thought to be part of a subpopulation that Cameron and Whitten (1979) have designated the Central Arctic herd. This herd is estimated to include about 5000 animals, and it is confined to the area between the Canning and Colville rivers. In years when the Arctic herd is large (for example, over 240,000 animals were reported in the late 1960s), many of these animals have apparently passed through the Prudhoe Bay region (Gavin 1980). There is also a small herd of about 300 caribou that are year-round residents on the northern coastal plain between the Sagavanirktok and Kuparuk rivers (Child 1973, 1974).

Insect harassment is responsible for much of the caribou movement during the summer. White et al. (1975) mapped the main routes of movement due to this response. They also studied the food preferences of the Prudhoe Bay caribou in relation to the early Prudhoe Bay vegetation map units of Webber and Walker (1975). The most commonly used vegetation types were those that had the highest percentages of sedges, grasses and willows. The sand dunes and coastal areas are very important to the caribou because the lower temperatures and onshore breezes dampen mosquito activity. Caribou often seek higher, relatively windy points such as pingos and roadways to escape the insects. Very wet sites, although high in potential nutrient availability, are not favored by caribou, possibly because of high insect levels in these areas. The favorite grazing areas are upland sites with graminoid tundra; riparian sites, particularly those with dwarf willows; and sand dune areas with prostrate willows (White et al. 1975).

Oil-field operations and construction activities have had an influence on caribou distribution and group composition. Studies by Cameron et al. (1979) show that caribou, particularly cows and calves, avoid the Prudhoe Bay oil field and the corridor of the trans-Alaska pipeline. In an earlier study, Child (1973, 1975) demonstrated that caribou avoid crossing a simulated pipeline barrier. The proliferation of roads, gathering lines and major pipelines on the Arctic Coastal Plain pose serious barriers to the continued heavy use of the region by caribou.

Foxes, lemmings and ground squirrels

Underwood (1975) and Hanson and Eberhardt (1978, 1979) studied the arctic fox (*Alopex lagopus*) in the region. The foxes range freely over the entire area, feeding on lemmings, birds and eggs. The dens are restricted to well-drained sites such as pingos, ridges and dry riverbanks. Hanson and Eberhardt (1979) suggested that the presence of man may dampen the cyclic population densities of foxes in the Prudhoe Bay region. Normally fox populations follow the cyclic patterns of the lemming. At Barrow the brown lemming population usually peaks every four to five years (Pitelka 1957, 1973), but similar cycles have not been detected at Prudhoe Bay. Gavin (1974) reported a lemming population high at Prudhoe Bay in 1969. Small fluctuations in the collared lemming (*Dicrostonyx groenlandicus*) population have been noted (Hanson and Eberhardt 1979), but these have little effect on fox densities. Garbage from the oil-field camps is thought to have a major effect on the fox, since the animals can rely on this food source in times of scarce prey (Hanson and Eberhardt 1979).

Arctic ground squirrels and collared lemmings, like the foxes, favor dry sites for their dens. Squirrel dens are common in sand dunes, river bluffs and pingos. The diet of the squirrels consists mostly of the shoots, rhizomes and bulbs of numerous

plants found in stabilized dune areas, riverbanks and pingos. Collared lemming burrows occur in drier tundra areas, such as on ridges, uplands and high-centered polygon complexes. Sedge nests of these animals are frequent in snowbank areas. Feist (1975) studied the Prudhoe Bay lemmings and found that the collared lemming is much more common than the brown lemming. Brown lemmings occur mainly in wet sites along the coast and along some streams. It appears that the animals are commonly associated with vegetation that has a large component of *Dupontia fisheri.*

Other mammals

There have been sightings of grizzly bears (*Ursus horribilis*) and wolves (*Canis lupus*) within the oilfield (Gavin 1974, 1980), although neither of these animals is common. Polar bears (*Thalarctus maritimus*) have also been sighted (Gavin 1980). One apparently denned in the area in 1978, but this is unusual. They mainly restrict their activities to the ice pack and occasionally visit the offshore islands. Gavin (1980) has also reported seeing moose (*Alces alces*), red foxes (*Vulpes fulva*) and least weasels (*Mustela rixosa*). Bee and Hall (1956) also reported the tundra hare (*Lepus othus*) from the delta of the Kuparuk River. They also found tracks of mink (*Mustela vison*) and river otters (*Lutra canadensis*) in the Kuparuk delta. Other taxa that may occur include the coyote (*Canis latrans*), two species of shrew (*Sorex cinereus* and *S. arcticus*), two voles (*Clethrionomys rutilus* and *Microtus oeconomus*) and possibly the lynx (*Lynx canadensis*). Recent research conducted under the IBP Tundra Biome Program and the RATE program (Research in Arctic Tundra Environments) has added much information regarding Arctic Slope caribou (White and Trudell 1980), microtines (Batzli et al. 1980, Batzli and Jung 1980) and arctic ground squirrels (Batzli and Sobaski 1980).

Birds

The birds of the region have been more intensively studied than the mammals. The most noteworthy reports are by Gavin (1974, 1980), Norton et al. (1975), Bergman et al. (1977), Bergman and Derksen (1977) and Hanson and Eberhardt (1977, 1979). Bergman et al. (1977) recorded 72 taxa during five summers at Storkersen Point. Twenty-five of these were breeding. A few kilometers inland, Norton et al. (1975) found 34 taxa nesting or suspected of nesting. Of these, 30 were water-related birds, that is, loons, waterfowl, shorebirds or gulls. The absence of shrub habitats at the coast restricts the number of terrestrial species. Shrub communities and habitat diversity increase inland, and ptarmigan and other birds associated with shrubs are more common (Kessel and Cade 1958). Shorebirds (plovers, sandpipers and phalaropes) are the most common nesters in the region. Of these the semipalmated sandpiper (*Calidris pusilla*) is by far the most common (Norton et al. 1975, Hanson and Eberhardt 1979). Other common nesting taxa include the red phalarope (*Phalaropus fulicarius*), dunlin (*Calidris alpina*), pectoral sandpiper (*Calidris melanotos*), northern phalarope (*Phalaropus lobatus*), buff-breasted sandpiper (*Tyngites subruficollis*) and Lapland longspur (*Calcarius lapponicus*). The Lapland longspur is one of only two passerines nesting in the region, the other being the snow bunting (*Plectrophenax nivalis*).

Hanson and Eberhardt (1979) reported nesting densities for semipalmated sandpipers and Lapland longspurs of 113 and 24 nests km^{-2}, respectively, with 146 nests km^{-2} for all species combined. Comparable data from the Colville River delta show 74 nests km^{-2} for all species, and at Franklin Bluffs there were only 25 nests km^{-2} (Hanson and Eberhardt 1979). J.P. Myers* studied densities of nesting shorebirds in relation to the vegetation map units in the Prudhoe Bay atlas (Walker et al. 1980). His study indicates that the lowest shorebird densities are associated with frost scar tundra (90 birds km^{-2}), and the highest densities are found in areas with mixed ponds and polygons, that is, areas with combinations of emergent vegetation, scattered polygon rims, islands and strangmoor features. These areas have up to 570 birds km^{-2}. The very high nesting densities observed at Prudhoe Bay should be considered in any early summer, off-road activities. Norton (1972) showed that even air-cushioned vehicles could have severe effects on nesting birds.

The waterfowl and loons in the region include the white-fronted goose (*Anser albifrons*), pintail (*Anas acuta*), oldsquaw (*Clangula hyemalis*), king eider (*Somateria spectabilis*), arctic loon (*Gavia arctica*), red-throated loon (*G. stellata*), Canada goose (*Branta canadensis*), black brant (*B. nigricans*) and whistling swan (*Olor columbianus*). Predator species include jaegers (*Stercorarius pomarimus, S. parasiticus,* and *S. longicaudus*), glaucous gulls (*Larus hyperboreus barrovianus*) and snowy owls (*Nyctea scandiaca*). Willow and rock ptarmigan (*Lagopus lagopus alascensis* and

* Personal communication, Academy of Natural Science and Vertebrate Biology, Philadelphia, Pennsylvania, 1977.

L. mutus nelsoni) are conspicuous in the region during the spring breeding season and in the fall, but like many of the regional birds they remain hidden in the tundra through most of the summer. The densities of the larger waterfowl and predators are much lower than for the shorebirds, about one nest km^{-2} for all species (Gavin 1973).

Bergman et al. (1977) developed a wetlands classification scheme for the coastal tundra near Storkersen Point and reported waterbird use in their various classification units. They also recommended several methods for protecting the arctic coastal wetlands in areas of oil-field development. Disturbances due to oil-field activities, such as noise, dust, blocked drainages during snowmelt, and oil spills, can cause major problems for waterfowl. The proliferation of powerlines poses another problem. The lines are the only obstacles on the open tundra for flocks of low-flying migrating birds. Bergman et al. (1977) emphasized that large tracts of coastal tundra should be set aside and protected from all activities to maintain the integrity of the unique breeding areas of the coastal region.

The recent interest in offshore drilling operations has sparked several bird population studies as part of the Outer Continental Shelf Environmental Assessment Program (e.g. Divoky 1978). Of particular relevance to Prudhoe Bay are the studies by Connors et al. (1979), which focused on the seasonal changes in habitat utilization by shorebirds and the relative susceptibility of the common species to oil spills and disturbances in the littoral zone.

The birds of Alaska's North Slope have been discussed in more general terms by Bailey (1948), Kessel and Cade (1958), Kessel and Schaller (1960), Pitelka (1974) and Sage (1974).

OIL-FIELD FACILITIES

Prudhoe Bay is a unique frontier metropolis. The two nearest native villages are Nuiqsut, 110 km west in the Colville River delta, and Kaktovik, 130 km east on Barter Island (Fig. 1). The nearest city is Fairbanks, about 600 km south. From the air the oil field appears as a sprawling array of small communities interconnected by a network of roads (Fig. 3). Most of the communities are, in fact, quarters and facilities for the various contractors and oil-field operators; others are part of the field operation and include pumping stations, drill sites, power generation facilities, gas compressor plants, airfields and docks. Many of what appear from the air to be roads are collections of pipelines that connect the drill sites to processing plants and ultimately to Pump Station No. 1 at the northern end of the trans-Alaska pipeline. The metropolis is thus totally organized around oil production, and there are virtually no community service facilities as in most municipalities, although some are being constructed.

Transportation to the region is provided via road, air and sea. The 650-km pipeline haul road connects the region with Fairbanks. Two airports capable of handling jet airliners are located at the state-operated airfield at Deadhorse and the Arco-owned Prudhoe Bay Airstrip. There are also two dock areas for offloading the barge convoys that converge there in late summer.

The oil field has grown rapidly. Twelve years ago there were only a few isolated exploratory wells and a small landing strip next to the Sagavanirktok River. Now the gravel road network is over 250 km long, and there are nearly as many kilometers of pipeline corridors within the region (see Brown and Walker [1980] for a history of the oil-field development). There are 33 drill sites, and each site has from 6 to 18 wells. The total area influenced by the oil field, not counting the Kuparuk Field operations, is about 250 km^2. The total size of the main oil pool is estimated to extend over 75 km along the coast and about 30 km inland, covering an area of about 650 km^2. The total estimated reserves are 10 billion barrels of oil and 20 trillion cubic feet of gas (Larminie 1976). The current annual production of about 1.5 million barrels is 17% of the total United States production (U.S. Army Corps of Engineers 1980).

ENVIRONMENTAL IMPACTS

The environmental impacts associated with the Prudhoe Bay oil field are difficult to enumerate, especially because of their magnitude and because the area was wilderness a few years ago. There have been numerous large studies of the impacts of present and future oil development in northern Alaska (e.g. Canadian Department of Indian Affairs and Northern Development 1973, Canadian Arctic Gas Study Ltd./Alaskan Arctic Gas Study Co. 1973, 1974, Canadian Environment Protection Board 1974, U.S. National Oceanic and Atmospheric Administration 1979, U.S. Department of Interior 1979, U.S. Army Corps of Engineers 1980). These studies touched on most aspects of impact, including wildlife; air, water and noise pollution; effects of off-road vehicles; sanitation

and waste disposal; erosion problems; conflicts with native land claims; degradation of fish habitat; archeological site degradation; social impacts; cumulative impacts; and aesthetics.

The effects on vegetation alone are numerous. Those that have been identified are caused by

1. Air pollution (Richardson 1974).
2. Roadside dust pollution (Webber et al. 1978, Everett 1980b, Werbe 1980).
3. Terrestrial oil spills (McCown et al. 1973, Hutchinson et al. 1974, Deneke et al. 1975, Hutchinson and Freedman 1975, McFadden et al. 1977, Walker et al. 1978).
4. Off-road vehicles (Burt 1970a, b, Abele et al. 1972, 1978, Radforth 1972, 1973a, b, Adam 1973, 1974, Barrett 1975, Adam and Hernandez 1977, Walker et al. 1977).
5. Saltwater spills associated with the Waterflood Project (U.S. Army Corps of Engineers 1980, Simmons et al. 1983).
6. Flooding associated with road construction (Walker and Webber 1980, U.S. Army Corps of Engineers 1980) and thermokarst (Lawson and Brown 1978).

Andreev (1976) has reviewed the numerous anthropogenic effects on tundra vegetation. Impact specifically related to oil development was discussed by Klein (1969), Bliss and Wein (1972), Babb (1973), Bliss and Peterson (1973), Babb and Bliss (1974), How and Hernandez (1975) and Lawson et al. (1978). Brown and Berg (1980) discussed some of the problems related to gravel road construction in permafrost terrain. Shafer (1979) discussed a method of using color IR photography to monitor vegetation impact around drill pads.

The Prudhoe Bay vegetation is particularly sensitive to impact for three principal reasons. First, it is in an extremely wet environment. The wet soils are easily compressed and displaced, resulting in ponding and the consequent major change in plant habitat. The extensive networks of vehicle tracks visible from the air in many places on the North Slope attest to this (Hok 1969). Also, the distribution of water on the tundra can be easily changed by road and pad construction, which dams the natural runoff of water in some areas and creates excessive and erosive flows in other areas. Ponded water, because it acts as a black body for heat, causes the permafrost table to degrade, resulting in thermokarst and the gradual enlargement of the flooded area, similar to the processes involved in thaw-lake formation.

Second, Prudhoe Bay's harsh climate affects a number of limiting physiological factors for the plants. The short growing season and low amounts of total summer warmth limit plant production. Many species found just a few kilometers south of Prudhoe Bay cannot grow in the extreme coastal environment. Very few woody plants are present. This means that many pioneering species (e.g. willows) are not available for recolonizing or are not particularly effective. Also, the amount of recovery that can occur in any single growing season is limited. This is evident along several abandoned peat roads in the region. These roads were abandoned in 1968 after the gravel road network was constructed. Near the coast the roads show virtually no recovery, with only a few scattered plants on the barren peat surface. Farther south the roads show much more recovery.

Third, many of the areas that contain some of the rarest and most beautiful plant communities are the same areas that attract activities associated with oil-field development. For example, pingos and vegetated river bars are the most vegetationally diverse areas within the region. Pingos, the only elevated spots in an otherwise flat landscape, are used as survey points, as high points for antennas, and for other activities. The rivers are necessary sources of gravel for roads and pads. Thus, both pingos and streams are subject to extensive man-caused degradation.

CHAPTER 3. MICROSCALE GRADIENTS

From high altitudes the tundra of the Arctic Coastal Plain appears as a vast, brown, barren land dissected by numerous meandering streams and braided rivers and covered with thousands of lakes and ponds. The narrow margins of the rivers and lakes are faintly green in midsummer, and the crests of the few hills appear slightly more barren than the surrounding terrain; other than that, it is difficult to see much evidence of changes in the vegetation along environmental gradients. Even when driving along the road that parallels the trans-Alaska pipeline, one is struck by the continuity of this flat region, and the differences in vegetation mostly go unnoticed. It is only when walking across the tundra that the different types of vegetation become apparent. Most of the changes that are detectable during a brief walk are due to differences in the amount of water available to the plants. With more time on the tundra, one can detect predictable patterns in response to other environmental gradients, such as snow, wind, frost-churning in the soil, and nitrification by animals. But still, many important gradients are undetectable by casual observation. A more detailed analysis becomes necessary to document the patterns that should be present in the Arctic as they are in other regions of the Earth.

PLANT COMMUNITIES ALONG THE MAJOR MICROSCALE GRADIENTS

The vegetation types in the region have been described briefly in the geobotanical atlas (Walker and Webber 1980). Table 3 is a list of the 42 types that have been recognized. Tables with vegetation and environmental data summaries for all stand types are in Appendix C. The methods used to collect these data are described later in this chapter. The nomenclature used for the vegetation units has been modified from that in the *Geobotanical Atlas of the Prudhoe Bay Region, Alaska* (Walker et al. 1980) to conform with the system of hierarchical tundra classification used for the Beechey Point Quadrangle (Walker 1983, Walker and Acevedo, in prep.).

Soil moisture gradient

Most of the microscale patterns discussed here are associated with the mosaics of patterned ground that dominate the tundra of the coastal plain. The soil moisture gradient plays a particularly important role in these patterns. With water at or near the surface all summer, the small differences in elevation associated with ice wedge polygons profoundly affect the vegetation. The strong interrelationships between vegetation, soils and landforms are well established in the Alaskan Arctic (Wiggins 1951, Koranda 1954, Tedrow et al. 1958, Cantlon 1961, Britton 1967, Peterson and Billings 1980). Cantlon emphasized that the degree of wetness controls the character of arctic vegetation to an even greater extent than in temperate regions. Wet conditions are generally pervasive due to the presence of permafrost. Elevation differences of a few centimeters can produce relatively mesic microenvironments that contrast sharply with the wetter microsites. The elevation differences can be geomorphic in origin, resulting from ice wedge polygon formation, or they may be due purely to the vegetation itself, as in the growth of moss polsters.

A generalized catena that shows the typical vegetation stand types and soil types occurring from the driest sites to the wettest sites will aid in understanding microrelief-vegetation relationships. Figure 7 depicts a moisture gradient in an alkaline tundra region from a small ridge about 2 m high to a lake margin. Vegetation in acidic areas will be discussed more thoroughly in the next chapter.

Dry tundra

Dry sites normally have mineral soils. The best-developed soils are Pergelic Cryoborolls. These soils have thick, well-developed mollic epipedons with free carbonates in the A horizon (Everett 1980e). Pergelic Cryopsamments may occur in dry sandy sites along the major rivers and on stabilized dunes.

The vegetation is usually either Stand Type B1 or B2. Dry *Dryas integrifolia, Carex rupestris, Oxytropis nigrescens, Lecanora epibryon* dwarf shrub, crustose lichen tundra (Stand Type B1, Fig.

VEGETATION

	B1	B2	U2 or U3	U4	M2	M4	E1	E2
Stand Type	B1	B2	U2 or U3	U4	M2	M4	E1	E2
Community Name	Dry *Dryas integrifolia Carex rupestris Oxytropis nigrescens Lecanora epibryon* dwarf shrub crustose lichen tundra	Dry *Dryas integrifolia Saxifraga oppositifolia Lecanora epibryon* dwarf shrub, forb tundra	Moist *Eriophorum angustifolium Dryas integrifolia Tomenthypnum nitens Thamnolia subuliformis* sedge, dwarf shrub tundra	Moist *Carex aquatilis Dryas integrifolia Salix arctica Tomenthypnum nitens* sedge, dwarf shrub tundra	Wet *Carex aquatilis Drepanocladus brevifolius* sedge tundra	Wet *Carex aquatilis Scorpidium scorpioides* sedge tundra	Aquatic *Carex aquatilis* sedge tundra	Aquatic *Arctophila fulva* grass tundra
SOIL	Pergelic Cryoboroll	Pergelic Cryoboroll	Pergelic Cryaquoll or Pergelic Cryosaprist or Histic Pergelic Cryaquept or Pergelic Cryaquept	Pergelic Cryosaprist or Pergelic Cryohemist or Histic Pergelic Cryaquept or Pergelic Cryaquept	Pergelic Cryohemist or Histic Pergelic Cryaquept or Pergelic Cryaquept	Pergelic Cryofibrist or Histic Pergelic Cryaquept or Pergelic Cryaquept	Pergelic Cryofibrist or Histic Pergelic Cryaquept or Pergelic Cryaquept	Detrital peat and floc

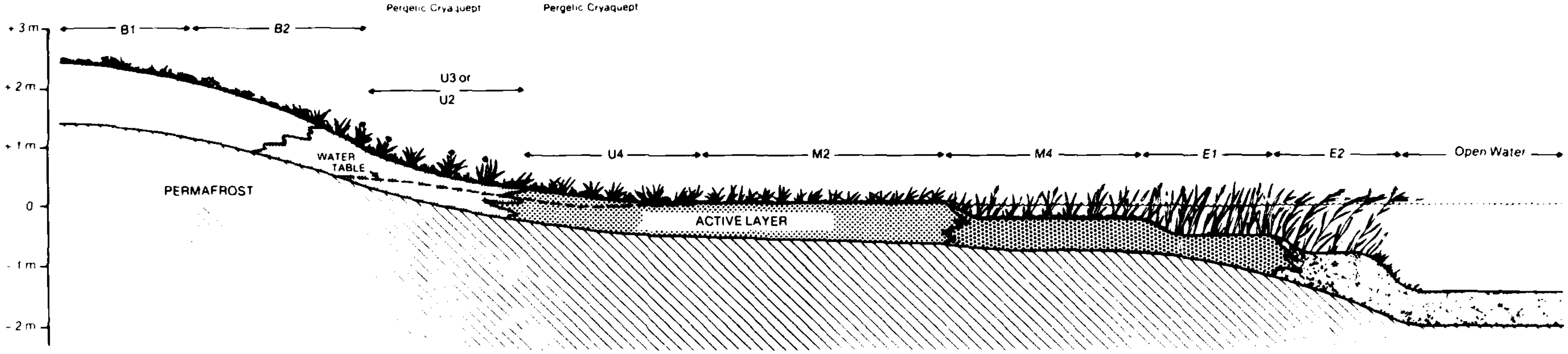


Figure 7. Moisture catena with typical vegetation and soils. The soil type depends on several factors, including age, depth of peat accumulation, and state of decomposition. Moist to very wet soils with shallow peat accumulation (less than 25 cm) are Pergelic Cryaquepts. Soils with more than 50% organic matter by weight in the top 80 cm are Histosols (Cryofibrists, Cryohemists, Cryosaprists). Soils with more than 25 cm of organic epipedon but less than required for Histosols are Histic Pergelic Cryaquepts.

Table 3. Vegetation stand types in the Prudhoe Bay region.
The botanical nomenclature follows Murray and Murray (1978).

Stand type	*Community*	*Characteristic microsite*	*Sample plot no.* *
B—Dry sites			
B1†	Dry *Dryas integrifolia, Carex rupestris, Oxytropis nigrescens, Lecanora epibryon* dwarf shrub, crustose lichen tundra	Pingos, ridges, high polygon centers, often gravelly soils	*010B, 1411,* 1520, *1001*
B2†	Dry *Dryas integrifolia, Saxifraga oppositifolia, Lecanora epibryon* dwarf shrub, crustose lichen tundra	Similar to Stand Type B1, but more organic soil with cryoturbation	*010A, 1401, 1505,* 1412, 1513
B3†	Dry *Saxifraga oppositifolia, Juncus biglumis* forb barren	Frost scars	0801, 1491, 1506
B4†	Dry *Epilobium latifolium, Artemisia arctica* forb barren	River gravel bars	1105, species list from Little Putuligayuk River
B5†	Dry *Dryas integrifolia, Salix ovalifolia, Artemisia borealis* dwarf shrub, forb barren	Sandy river terraces, stabilized	*1207*
B6†	Dry *Dryas integrifolia, Astragalus alpinus* dwarf shrub, forb tundra	Riverbanks	*1507*
B7†	Dry *Braya purpurascens, Anemone parviflora, Arctagrostis latifolia* forb, grass tundra	Slumping river bluffs	*1104*
B8	Dry *Cochlearia officinalis, Puccinellia phryganodes* forb, grass barren	Coastal beaches	*1312*
B9	Dry *Elymus arenarius, Dupontia fisheri* grass barren	Active sand dunes, sandy creek banks	*1201*
B10	Dry *Braya purpurascens, Puccinellia andersonii* forb, grass barren	Coastal bluffs with salt-killed vegetation	1301
B11	Dry *Dryas integrifolia, Sedum rosea* prostrate shrub, forb tundra	Dry coastal bluffs and ridges	Species list from vicinity of mouth of Putuligayuk River
B12	Dry *Salix rotundifolia, Salix planifolia* ssp. *pulchra, Ochrolechia frigida* dwarf shrub, crustose lichen tundra	Coastal high polygon centers	*1305*
B13	Dry *Salix ovalifolia, Artemisia borealis* dwarf shrub, forb tundra	Stabilized sand dunes	*1208,* 1202, 1106
B14†	Dry *Dryas integrifolia, Salix reticulata, Cetraria richardsonii* dwarf shrub, fruticose lichen tundra	Dry, early-thawing snowbanks with hummocky terrain	Species list from pingo near Pad F
B15	Moist *Salix rotundifolia, Carex aquatilis, Dicranum elongatum, Ochrolechia frigida* dwarf shrub, crustose lichen tundra	Coastal polygon rims and high polygon centers	1313
U—Moist sites			
U1†	Moist *Carex aquatilis, Dryas integrifolia, Ochrolechia frigida* sedge, dwarf shrub, fruticose lichen tundra	Polygon rims and aligned hummocks in acidic tundra region	*1405, 1406,* 1410, 1415
U2†	Moist *Eriophorum vaginatum, Dryas integrifolia, Tomenthypnum nitens, Thamnolia subuliformis* tussock sedge, dwarf shrub tundra	Well-drained upland sites	*0203*
U3†	Moist *Eriophorum angustifolium, Dryas integrifolia, Tomenthypnum nitens, Thamnolia subuliformis* sedge, dwarf shrub tundra	Well-drained upland sites, polygon rims, aligned hummocks	*020B, 1403, 1406, 1409, 1504, 1510,* 1515
U4†	Moist *Carex aquatilis, Dryas integrifolia, Salix arctica, Tomenthypnum nitens* sedge, dwarf shrub tundra	Moister upland sites, centers of drier low polygon centers, polygon rims, aligned hummocks	*030B, 0303,* 030A, 1512, 1514, *1519*
U6†	Dry *Dryas integrifolia, Cassiope tetragona, Cetraria nivalis* dwarf shrub, fruticose lichen tundra	Well-drained snowbanks	*0901,* 1416, 1509
U7†	Moist *Salix rotundifolia, Equisetum scirpoides* dwarf shrub tundra	Late-thawing snowbanks	*0902,* 1417

* Italicized plot numbers are 1- × 10-m ordination plots; the remainder are 1- × 1-m plots.
† Occurs on at least one of the four master maps (Walker et al. 1980).

Table 3 (cont'd). Vegetation stand types in the Prudhoe Bay region.

Stand type	*Community*	*Characteristic microsite*	*Sample plot no.**
U8†	Moist *Salix lanata, Carex aquatilis* dwarf shrub, sedge tundra	Streambanks, lake margins	1103
U9†	Moist *Dryas integrifolia, Eriophorum angustifolium, Tomenthypnum nitens, Didymodon asperifolius* dwarf shrub, sedge, moss tundra	Upland streambanks that are swept by the spring flood	*1102*
U10†	Moist *Festuca baffinensis, Papaver macounii, Ranunculus pedatifidus* forb, grass tundra	Pingo tops, bird mounds and animal dens	1002, 1418, 1502, 1422
U12	Moist *Carex aquatilis, Salix planifolia* ssp. *pulchra, Campylium stellatum* sedge, dwarf shrub tundra	Mesic coastal meadows	1303, *1311*
U13	Moist *Dupontia fisheri, Cochlearia officinalis* grass, forb tundra	Coastal meadows below highest strand line	*1309*
U14	Moist *Carex aquatilis, Dryas integrifolia* sedge, dwarf shrub tundra	Polygon rims in sand dune region	*1210*
M—Wet sites			
M1†	Wet *Carex aquatilis, Carex rariflora, Saxifraga foliolosa* sedge, forb tundra	Wet microsites in acidic tundra areas primarily associated with aligned hummocks	*1420*, 1414, 1404, 1407
M2†	Wet *Carex aquatilis, Drepanocladus brevifolius* sedge tundra	Wet polygon centers and troughs, lake margins	*040B, 1503, 1511, 1516, 1501, 040A*, 1308, 1304
M3†	Wet *Carex aquatilis, Dupontia fisheri, Calliergon richardsonii* sedge tundra	Wet polygon centers and meadows in sand dune region and along Kuparuk River	1203, *1205*
M4†	Wet *Carex aquatilis, Scorpodium scorpioides* sedge tundra	Low, wet sites, polygon centers, drained lakes, lake margins	*050A, 050B*, 1517
M5†	Wet *Carex aquatilis, Salix rotundifolia* sedge, dwarf shrub tundra	Moist streambanks	*1101, 1508*
M6	Wet *Juncus arcticus, Salix ovalifolia* rush, dwarf shrub tundra	Wet, sandy river bars	Species list from Sagavanirktok R. delta
M7	Wet *Equisetum arvense, Alopecurus alpinus* horsetail, grass tundra	Wet, sandy sites along rivers	1107
M8	Wet *Dupontia fisheri, Carex aquatilis, Campylium stellatum* graminoid, moss tundra	Wet polygon troughs in coastal vicinity	1306
M9	Wet *Carex subspathacea, Puccinellia phryganodes* sedge tundra	Coastal estuaries and lagoons	1302, *1318*
M10	Wet *Carex aquatilis, Dupontia fisheri, Eriophorum angustifolium* graminoid tundra	Coastal wet polygon centers and meadows	*1310*
M11	Wet *Carex aquatilis, Dupontia fisheri, Salix ovalifolia* graminoid, dwarf shrub tundra	Wet areas in sand dune region	*1209*
E—Emergent sites			
E1†	Aquatic *Carex aquatilis* sedge tundra	Water to about 30 cm	*1402, 1408, 1413*, 1518
E2†	Aquatic *Arctophila fulva* grass tundra	Water to about 100 cm	*060B, 060A, 1307*
E3†	Aquatic *Scorpidium scorpioides* moss tundra	Water to about 100 cm in sand dunes region	*1206*
E4†	Aquatic *Dupontia fisheri, Carex aquatilis* graminoid tundra	Shallow water in sand dunes	Species list from dunes area
W—Open water			
W1†	None	Lakes and ponds	
W2†	None	Streams and rivers	
W3†	Varies	Flooded areas caused by roads or pads	

Table 3 (cont'd).

Stand type	*Type of disturbance*	*Characteristic microsite*	*Sample plot no.**
D—Disturbed sites			
D1†	Bare earth with pioneering species, e.g. *Braya purpurascens, Ceratodon purpureus, Bryum* spp., *Marchantia polymorpha*		
D2†	Foreign gravel or construction debris		
D3†	Dust-covered areas adjacent to roads		
D4†	Vehicle tracks, deeply rutted		
D5†	Vehicle tracks, not deeply rutted		
D6†	Winter road		
D7†	Excavated areas, primarily in river gravels		
W3†	Flooded areas caused by roads or pads		

* Italicized plot numbers are 1- × 10-m ordination plots; the remainder are 1- × 1-m plots.
† Occurs on at least one of the four master maps (Walker et al. 1980).

Figure 8. Stand Type B1. Dry Dryas integrifolia, Carex rupestris, Oxytropis nigrescens, Lecanora epibryon *dwarf shrub, crustose lichen tundra on a pingo near the Kuparuk River.*

8) consists of a discontinuous mat of *Dryas integrifolia* and a few cushion plants such as *Oxytropis nigrescens* and *Saxifraga oppositifolia.* Sedges are scattered and are mainly *Carex rupestris.* Erect dicotyledons include *Draba alpina, Chrysanthemum integrifolia, Papaver lapponicum, Lesquerella arctica, Pedicularis lanata* and *P. capitata.* A high percentage of the soil is unvegetated or is vegetated with crustose lichens, including *Lecanora epibryon, Ochrolechia frigida* and *Pertusaria* spp. Often there is a fine pattern of small nonsorted polygons about 20-50 cm in diameter. These are apparently caused by a combination of frost activity and desiccation. The depressions between these small polygons are generally 5-15 cm deep and contain a much richer assortment of mosses and lichens than the tops. Taxa in the depressions include *Thamnolia subuli-*

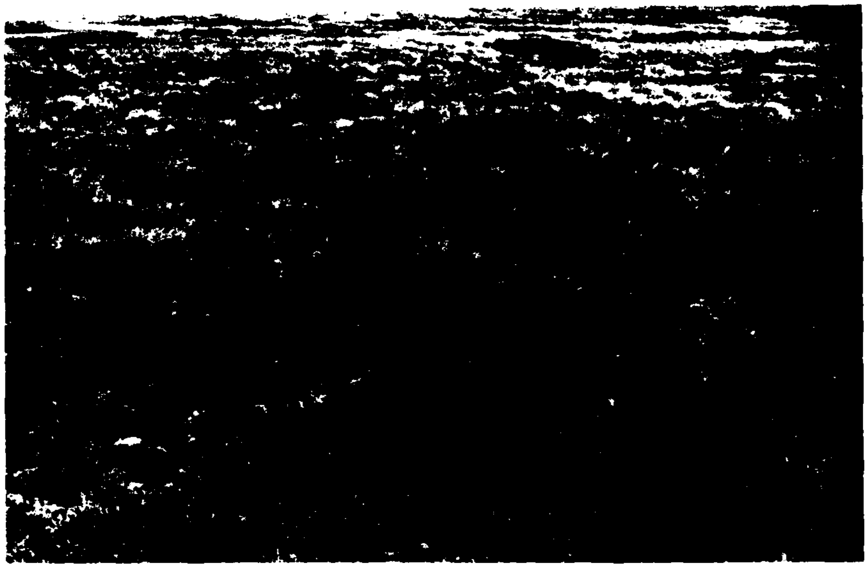


Figure 9. Stand Type B2. Dry Dryas integrifolia, Saxifraga oppositifolia, Lecanora epibryon *dwarf shrub, crustose lichen tundra on the margin of a drained lake.*

formis, Cetraria cucullata, C. islandica, Peltigera canina, Bryum spp., *Encalypta alpina, E. procera* and *Drepanocladus uncinatus.*

Dry *Dryas integrifolia, Saxifraga oppositifolia, Lecanora epibryon* dwarf shrub, crustose lichen tundra (Stand Type B2, Fig. 9) occurs on slightly moister sites that often have more evidence of frost stirring. Typical sites for Type B2 include high-centered polygons and the margins of drained lake basins and creek bluffs. *Saxifraga oppositifolia, Salix reticulata* and *S. arctica* are usually more abundant than in Stand Type B1, and *Carex rupestris* and *Oxytropis nigrescens* are less likely to occur here than in Type B1.

Moist tundra

Mesic upland sites generally have moist graminoid tundra with either Stand Type U3 (moist *Eriophorum angustifolium, Dryas integrifolia, Tomenthypnum nitens, Thamnolia subuliformis* sedge, dwarf shrub tundra, Fig. 10 and 11) or U4 (moist *Carex aquatilis, Dryas integrifolia, Salix arctica, Tomenthypnum nitens* sedge, dwarf shrub tundra). The primary difference between these two types is the relative abundance of lichens. Type U4 is wetter and has few or no fruticose lichens (e.g. *Thamnolia subuliformis, Dactylina arctica, Cetraria cucullata, C. islandica*). Both types are dominated by sedges (e.g. *Eriophorum angustifolium* ssp. *triste, Carex aquatilis, C. bigelowii, C. membranacea, C. misandra* and *C. atrofusca*) and *Dryas integrifolia.* Dwarf willows (*Salix arctica, S. reticulata, S. lanata*) are also important, particularly in Stand Type U4. The principal erect dicots are *Chrysanthemum integrifolia, Senecio atropurpureus* ssp. *frigidus, Pedicularis lanata, P. capitata, Polygonum viviparum* and *Papaver macounii.* The moss carpet is dominated by *Tomenthypnum nitens, Ditrichum flexicaule, Distichium capillaceum, Hypnum bambergeri, Orthothecium chryseum* and *Drepanocladus brevifolius.* Some upland sites, particularly in the western part of the area, have large components of *Eriophorum vaginatum* but are otherwise similar to Stand Type U3. This vegetation is designated Stand Type U2.

Moist tundra areas normally are drained of standing water soon after spring breakup, and they offer firm footing throughout the summer. Typical moist graminoid microsites include polygon rims, the tops of poorly developed high-centered polygons, strangs in areas of strangmoor, and well-drained terrain along streams and the lower gentle slopes of pingos. Stand Type U4 often occurs in the better drained parts of recently drained lake basins that have no patterned ground features. In these sites the sedge carpet is often quite dense and there are few or no lichens.

Soils in the moist tundra areas are normally either Pergelic Cryaquolls in the better drained

Figure 10. Stand Type U3. Moist Eriophorum angustifolium, Dryas integrifolia, Tomenthypnum nitens, Thamnolia subuliformis *sedge, dwarf shrub tundra.*

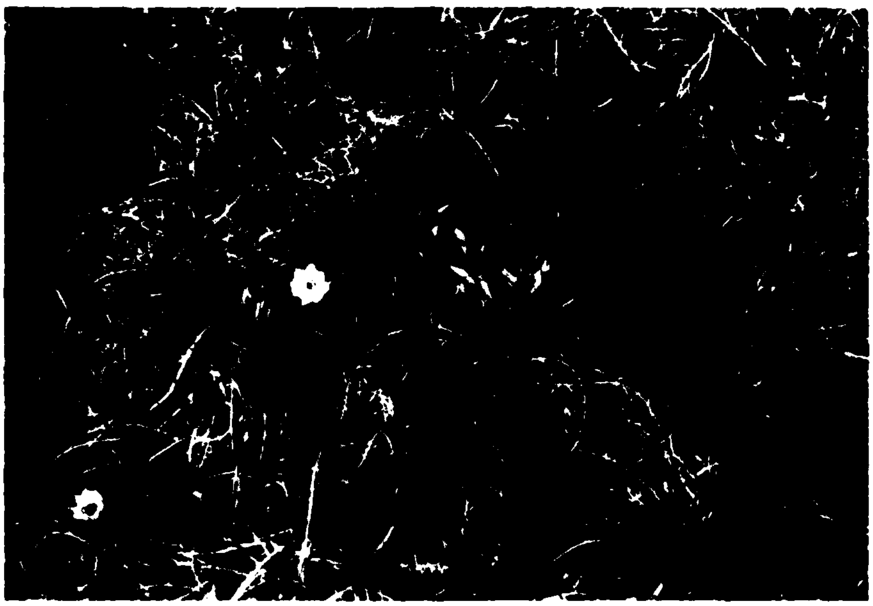


Figure 11. Close-up of Stand Type U3, showing lichens.

areas or Pergelic Cryosaprists in areas with thick organic layers. In moist tundra areas where the organic layer is shallow, such as recently drained lake basins or streambanks, the soils are Pergelic Cryaquepts or Histic Pergelic Cryaquepts. Pergelic Cryaquolls normally show distinct red mottles of iron oxide above a certain level in the A horizon; these probably represent the mean level of seasonal oxidation (Everett 1980e).

Frost scars are common features on upland surfaces. Vegetation on these features is often Stand Type B3, which will be discussed in more detail later. Soils in the frost scars are usually olive-grey soils (Pergelic Cryaquepts) and the association

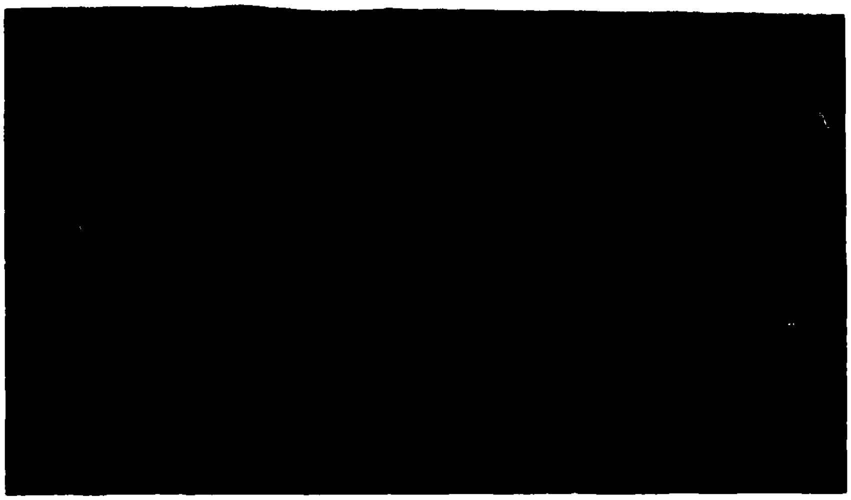


Figure 12. Stand Type M2. Wet Carex aquatilis, Drepanocladus brevifolius *sedge tundra in the basin of low-centered polygon.*

with the Pergelic Cryaquolls in the inter-frost-scar areas has been termed a Pergelic Ruptic Aqueptic Cryaquoll (Everett 1980e).

Wet tundra

Wet sedge tundra is associated with poorly drained areas tha. usually have standing water early in the summer but that drain later in the year except during rainy periods. The soils are saturated at all times.

The most common community is wet *Carex aquatilis, Drepanocladus brevifolius* sedge tundra (Stand Type M2, Fig. 12). This vegetation is composed mostly of sedges. *Carex aquatilis* is the most common, but others, such as *Eriophorum russeolum, Carex rotundata* and especially *Eriophorum angustifolium* ssp. *subarcticum*, are also common. Dwarf willows, such as *Salix lanata* and *S. arctica*, are occasional. There are only a few erect dicotyledons found in these areas. The most common is *Pedicularis sudetica* ssp. *albolabiata,* but others include *Saxifraga hirculus, Silene wahlbergella* and *Cardamine pratensis*. The moss carpet is dominated by *Drepanocladus lycopodioides* var. *brevifolius* and other members of the Amblystegiaceae, such as *Scorpidium scorpioides, Drepanocladus* spp. and *Calliergon richardsonii.* Other common mosses include *Cinclidium latifolium, C. arcticum, Meesia triquetra, Distichium capillaceum, Catascopium nigritum* and *Campylium stellatum*. The mosses are often covered by a layer of calcium carbonate precipitates. Lichens are usually absent. Large thalli of the alga *Nostoc commune* are common.

The most common soils are either Pergelic Cryohemists or Histic Pergelic Cryaquepts. The organic matter of these soils is somewhat less decomposed than the Cryosaprists or Histic Pergelic Cryaquepts on more well-drained sites. There are recognizable plant parts, such as roots and leaves, in the peat (Everett 1980e). Areas with shallow organic layers have Pergelic Cryaquepts. Typical microsites include the basins and troughs of low-centered polygons, the margins of ponds, lakes and streams, and the intermittently wet areas of drained lake basins.

Aquatic tundra

Semi-emergent and emergent communities are found in areas that are normally continuously covered with water throughout the summer. Wet *Carex aquatilis, Scorpidium scorpioides* sedge tundra (Stand Type M4, Fig. 13) occurs in areas that have shallow water (less than 10 cm deep). This is considered a transitional type between wet sedge tundra and aquatic tundra vegetation. A thick carpet of the moss *Scorpidium scorpioides* distinguishes this type. The primary sedge is *Carex aquatilis,* but *C. saxatilis, C. rotundata* and *Eriophorum angustifolium* are also common. The only common

Figure 13. Stand Type M4. Wet Carex aquatilis, Scorpidium scorpioides *sedge tundra in a drained lake basin.*

Figure 14. Stand Type E1. Aquatic Carex aquatilis *sedge tundra on the edge of a small lake.*

dicotyledon is *Pedicularis sudetica* ssp. *albolabiata*. Lichens are absent. The alga *Nostoc* is abundant, and in some areas it is the dominant plant. Some Type M4 areas may be drained in abnormally dry years.

Sites with deeper water or a denser sedge cover usually do not have any moss vegetation. These areas often have aquatic *Carex aquatilis* sedge tundra (Stand Type E1, Fig. 14). Other taxa include *Eriophorum scheuchzeri, Caltha palustris* and *Utricularia vulgaris*. Type E1 areas normally occur in the shallow margins of lakes, especially partially drained lake basins with complex terrains of ponds and intermittent polygon rims, islands, and strangmoor features. The water is normally less than 30 cm deep. The soils in these very wet tundra sites show virtually no signs of decomposition. If the undecomposed horizon is sufficient for the soil to be a Histosol (more than 50% organic matter by weight in the top 80 cm), the soil is termed a Cryofibrist. Soils with less organic matter are generally Histic Pergelic Cryaquepts (Everett 1980e).

Many lakes and ponds have a distinctive band of vegetation composed almost exclusively of the grass *Arctophila fulva* (Stand Type E2, Fig. 15). This plant grows in up to one meter of water and is

Figure 15. Stand Type E2. Aquatic Arctophila fulva *grass tundra in the center of a small oriented thaw lake.*

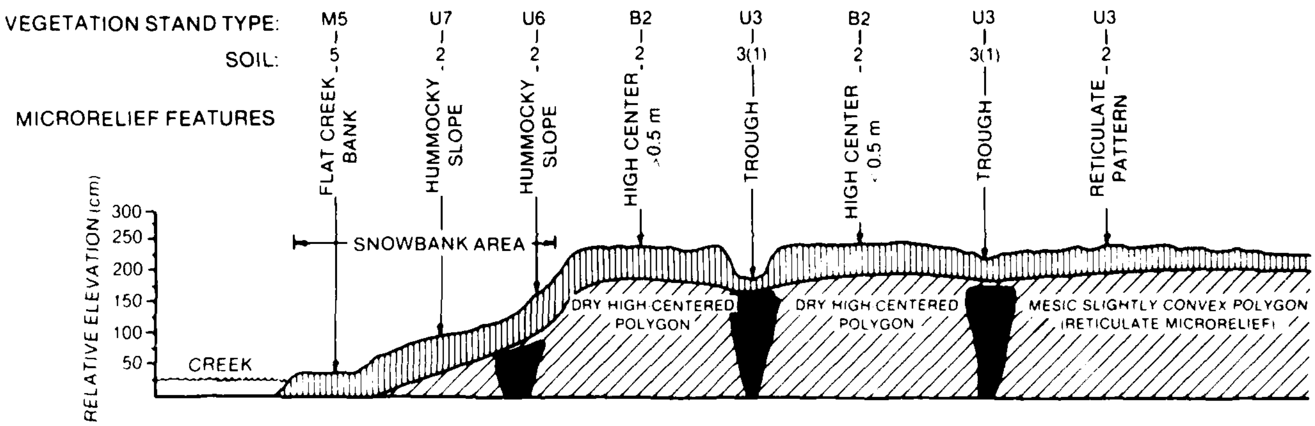


Figure 16. Idealized section of Prudhoe Bay tundra showing various types of polygons. Typical vegetation and microrelief are shown for each element of the polygons. Refer to Table 2 for an explanation of the soil codes.

especially common in partially drained lake basins. It is not so common in large oriented lakes that do not have protected embayments. It is also not common in those ponds and lakes with a thick layer of marl on the bottom. In some areas, especially in beaded streams, the emergent vegetation includes other taxa, such as *Caltha palustris, Hippuris vulgaris, Utricularia vulgaris,* and occasionally *Sparganium hyperboreum* and *Calliergon giganteum.*

Relationships between soil moisture gradient and patterned ground features.

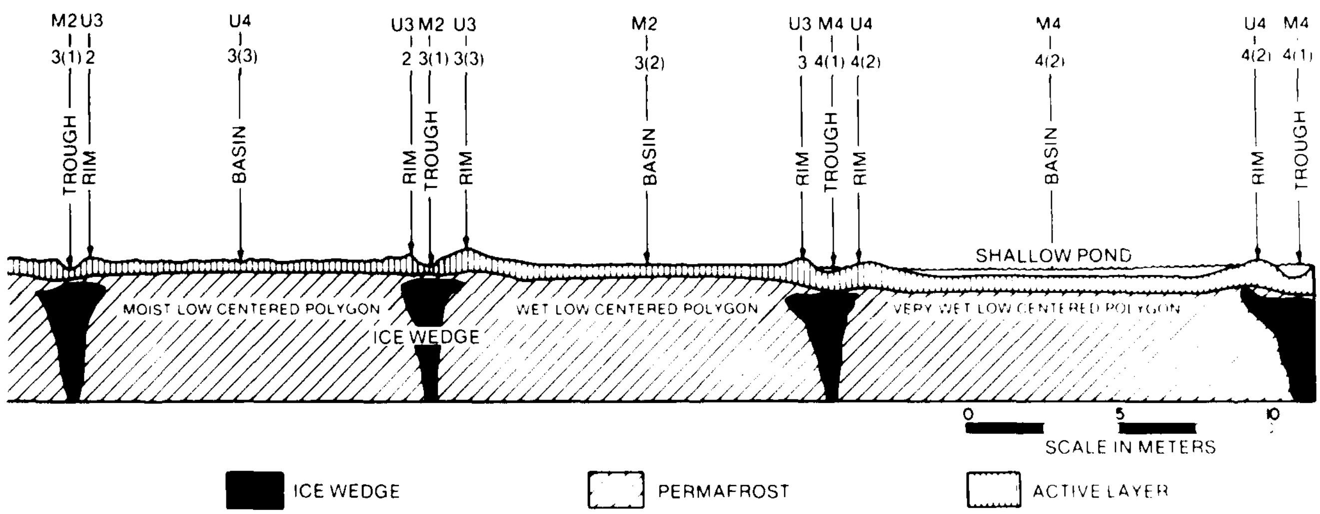
Patterned ground creates a mosaic of vegetation communities that can be extremely confusing until one recognizes that in most cases there is a repetitious pattern of only a few main stand types. This is not unlike the situation in temperate regions, except that the scale of variation is smaller. In networks of polygons there are relatively elevated sites associated with polygon rims, strangs and high polygon centers, and relatively low sites associated with polygon basins, troughs and interhummock areas.

The plant community is, to a large extent, controlled by the amount of soil moisture that the site can retain. Since most tundra plants have shallow root systems, the moisture in the surface layer is most important. In some cases a wet, anaerobic soil can underlie vegetation composed of taxa normally associated with drier microsites. This situation is more common with highly organic soils and is particularly common farther south, where the accumulation of mosses and lichens, especially *Sphagnum* and *Cladonia,* is sufficient to create drier habitats. In the Prudhoe Bay region, cryptogam accumulations are generally not thick; the deepest living moss carpets are about 10 cm deep and are normally about 3–7 cm deep. However, moss hummocks initiated by such taxa as members of the Splachnaceae, *Bryum* spp., *Catoscopium nigritum* and *Aulacomnium palustre* can create relatively mesic sites. Sometimes these small hummocks, particularly those of the Splachnaceae, form around caribou feces or dead lemmings. The slow accumulation of dead sedge leaves and roots, dead mosses and other organic debris, in combination with the annual input of loess, gradually creates a somewhat elevated surface suitable for more mesophytic taxa.

Figure 16 depicts an idealized section of Prudhoe Bay tundra, showing a variety of polygons that could occur next to a small stream. Ice wedges underlie the surface. Near the stream, thermal erosion has caused deeper polygon troughs and relatively well drained high-centered polygons. Soils on the tops of these polygons are Pergelic Cryaquolls. Vegetation on the high centers is Type B2 (dry *Dryas integrifolia, Saxifraga oppositifolia, Lecanora epibryon* dwarf shrub, crustose lichen tundra). The troughs of these polygons are moister than the tops, with well-decomposed Histic Pergelic Cryaquepts and Stand Type U3 vegetation (moist *Eriophorum angustifolium, Dryas integrifolia, Tomenthypnum nitens, Thamnolia subuliformis* sedge, dwarf shrub tundra).

Areas farther from the stream (Fig. 16, second and third polygons from the left) have somewhat less well developed high-centered polygons, with less than 0.5 m of relief contrast. These surfaces are moderately well drained, with Pergelic Cryaquoll soils and Type U3 vegetation.

Still farther from the stream (Fig. 16, fourth polygon from the left) low-centered polygons oc-



cur with only slightly depressed basins. These basins have numerous small hummocks (less than 15 cm high) that give the basin a mesic character. The soil in the polygon basin is a Pergelic Cryosaprist. The vegetation in the basin is Type U4 (moist *Carex aquatilis, Dryas integrifolia, Salix arctica, Tomenthypnum nitens* sedge, dwarf shrub tundra). The rims of the polygon are somewhat better drained, with Pergelic Cryaquolls and Type U3 vegetation. The most noticeable difference between the vegetation on the rim and that in the center of this polygon is the abundance of fruticose lichens on the rim and their scarcity in the basin.

The next polygon (Fig. 16, second from the right) is less well drained. The soil in the basin is a saturated Pergelic Cryohemist, and the vegetation is Type M2 (wet *Carex aquatilis, Drepanocladus brevifolius* sedge tundra). The troughs have less organic matter accumulation and are Histic Pergelic Cryaquepts. The rims are relatively well drained, with Pergelic Cryosaprist soils and Type U3 vegetation.

The last polygon is very poorly drained and is associated with a wet drained lake basin or a small lake. There is standing water in the polygon basin and troughs. The soil in the basin is a Pergelic Cryofibrist and the vegetation is Type M4 (wet *Carex aquatilis, Scorpidium scorpioides* sedge tundra). The rim is poorly developed, with Pergelic Cryofibrist soil and Type U4 vegetation.

Snow depth gradient

Snowbanks are not particularly common in the region because of the flatness of the terrain, but they do occur around the bases of pingos, along the coastal bluffs, and in all the drainage systems. Snowbanks on stable slopes often have three distinct bands of vegetation.

The uppermost band of vegetation, dry *Dryas integrifolia, Salix reticulata, Cetraria richardsonii* dwarf shrub, fruticose lichen tundra (Stand Type B14, Fig. 17), is the least distinct and often grades imperceptibly into Types B1, B2 or U3 at the top of the snow area. This could be considered the lichen band, since there is usually an abundant cover of such taxa as *Cetraria nivalis, C. islandica, C. cucullata, C. richardsonii, Alectoria nigricans, A. ochroleuca, Cornicularia divergens* and *Stereocaulon* spp. Vascular taxa include *Dryas integrifolia, Salix reticulata, Pedicularis capitata, Papaver macounii* and *Astragalus umbellatus.* The main mosses are *Tomenthypnum nitens, Rhytidium rugosum, Drepanocladus uncinatus, Ditrichum flexicaule* and *Thuidium abietinum.*

The central band, dry *Dryas integrifolia, Cassiope tetragona, Cetraria nivalis* dwarf shrub, fruticose lichen tundra (Stand Type U6, Fig. 18), is the easiest to recognize because of the abundance of *Cassiope tetragona.* The moss and lichen cover is similar to that in Stand Type B14. Other important vascular taxa include *Salix rotundifolia, S. reticulata, Pedicularis capitata, Carex scirpoidea,*

Figure 17. Snowbank site along a channel of the Kuparuk River. The vegetation in the foreground is mainly Type B14, Dry Dryas integrifolia, Salix reticulata, Cetraria richardsonii *dwarf shrub, fruticose lichen tundra.*

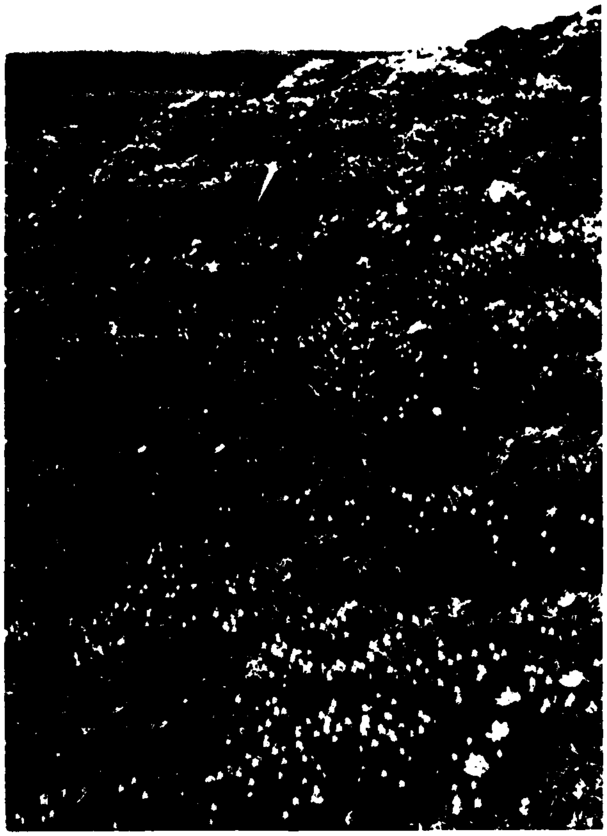


Figure 18. Stand Type U6. Dry Dryas integrifolia, Cassiope tetragona, Cetraria nivalis *dwarf shrub, fruticose lichen tundra in the snowbank on the west side of a pingo near Frontier Camp.*

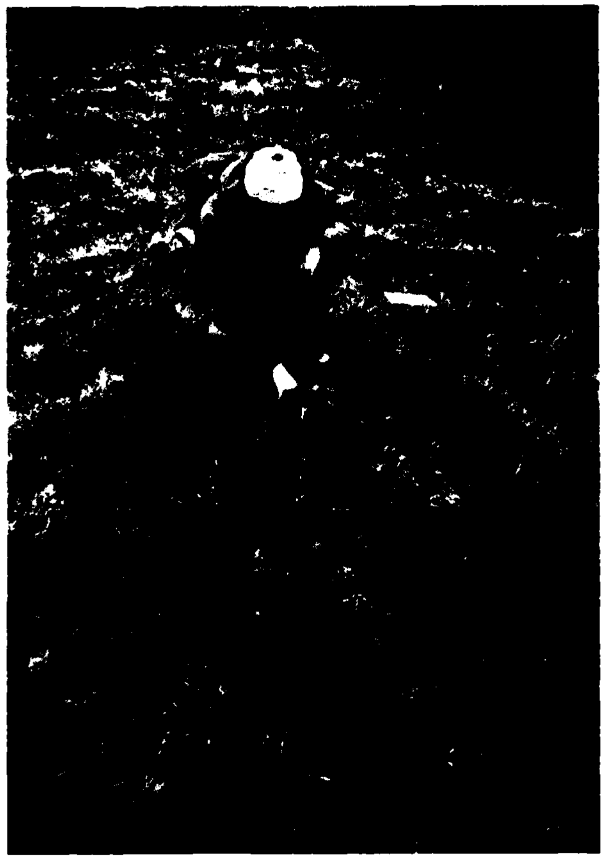


Figure 19. Stand Type B3. Dry Saxifraga oppositifolia, Juncus biglumis *forb barren on a frost scar near the Putuligayuk River.*

Polygonum viviparum, Chrysanthemum integrifolium, Lloydia serotina, Silene acaulis and *Papaver macounii.* This band usually occurs in portions of the snowbank that are steep and very hummocky and have well-drained soils. Snow depths were never measured in these areas, but it is likely that some of these sites have over 2 m of snow in early spring.

The lowest band, moist *Salix rotundifolia, Equisetum scirpoides* dwarf shrub tundra (Stand Type U7), occurs in the deepest portions of the snow patch, which melt out last. Often these are gently sloping areas, but the community can also occur on fairly steep portions of snowbanks. *Salix rotundifolia* forms a tight carpet in these areas. Other taxa include *Carex aquatilis, Eriophorum angustifolium* ssp. *triste, Salix reticulata, Senecio atropurpureus, Equisetum variegatum, E. scirpoides, Distichium capillaceum, Ditrichum flexicaule* and *Pohlia* spp. In stream areas this community grades into Type M5, which is the *Carex aquatilis*-dominated wet streamside type (Table 3). Communities in the lower parts of snowbanks are complex; they are often indistinct, grading into the surrounding moist sedge tundra. Solifluction is often prevalent near the bases of slopes, and pioneering taxa such as *Equisetum arvense* and *Arctagrostis latifolia* are common.

Cryoturbation gradient

Frost scars are common features on most upland surfaces and in many wet areas. The vegetation cover on these features varies from 0 to 100%. The most distinctive frost scar communities occur where there is only a small amount of vegetation cover. Dry *Saxifraga oppositifolia, Juncus biglumis* forb barren (Stand Type B3, Fig. 19) occurs on these features and is very distinctive in spring when the *Saxifraga* blooms. Usually frost scars are slightly higher than the general surface of the tundra, and the bare soils are subject to desiccation and cracking in dry weather. Most

Figure 20. Bird mound near Drill Site 2.

taxa are from the dry end of the moisture gradient, including *Dryas integrifolia, Minuartia arctica, M. rubella, Chrysanthemum integrifolia, Eriophorum angustifolium* ssp. *triste, Distichium capillaceum, Bryum wrightii, Encalypta* spp., *Lecanora epibryon* and *Thamnolia* spp.

Other types of frost features include turf hummocks and solifluction features. These are relatively minor in the Prudhoe Bay region and were not sampled.

Animal activity gradient

Numerous vegetation features in the region are due to the presence of animals. These include small features, such as moss hummocks that form around owl cough pellets, caribou feces, lemming carcasses and other small pieces of animal litter, and larger features, such as bird mounds and the lush growth around ground squirrel and fox dens. The luxuriant grasses and dicotyledons associated with animal dens and bird mounds are a response to more fertile mineral soils due to animal excreta and debris from kills.

Bird mounds (Fig. 20) are a common feature in the region. They reach heights of 30–100 cm above the general level of the terrain. They are most often formed at the intersections of low-centered polygon rims or other sites where there is a slightly higher vantage point from which a bird can observe the surrounding terrain. Glaucous gulls, snowy owls and jaegers commonly use these sites. Typical vascular plant species include *Festuca baffinensis, F. rubra, Arctagrostis latifolia, Dryas integrifolia, Alopecurus alpinus, Astragalus umbellatus, Senecio atropurpureus* and *Poa* spp. The principal mosses include *Thuidium abietinum, Drepanocladus uncinatus, Rhytidium rugosum, Hypnum procerrimum* and *Tortula ruralis*. The lichens are similar to those found in Type U3 areas.

Foxes and ground squirrels prefer mineral soils on pingos, river bluffs and dunes. The vegetation surrounding their dens (Fig. 21) is among the richest in the region and includes, in addition to the taxa mentioned above, *Polemonium boreale, Ranunculus pedatifidus, Poa alpigena, P. glauca, P. pratensis, Bromus pumpellianus, Draba* spp., *Saxifraga caespitosa, S. tricuspidata, Androsace septentrionalis, Oxytropis maydelliana, Potentilla uniflora, P. hookeriana, P. hyparctica, Taraxacum ceratophorum* and *T. phymatocarpum*. The rich vegetation on bird mounds and animal dens has been designated Stand Type U10.

Other microscale gradients

There are a variety of other gradients that are included here. Sampling along these gradients was not sufficient to treat them with the depth they deserve, so the discussion is quite general.

Coastal areas

The coastal beaches at Prudhoe Bay are mostly sandy and are often strewn with peat blocks erod-

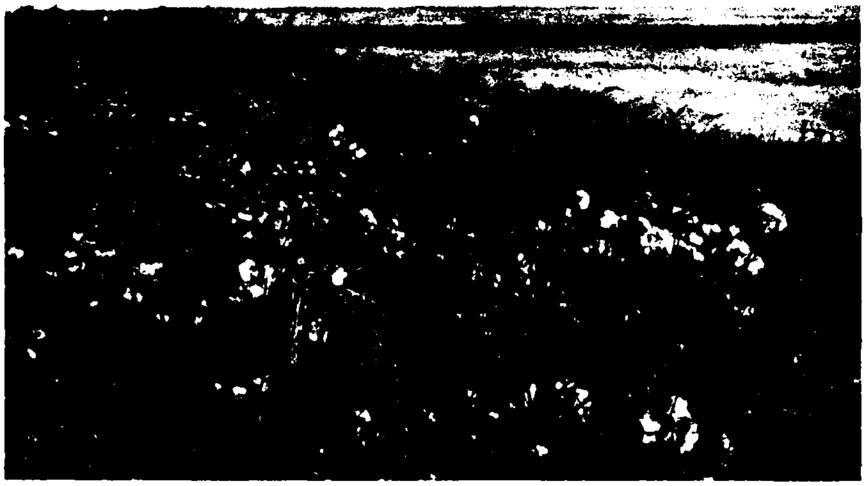


Figure 21. Stand Type U10. Moist Festuca baffinensis, Papaver macounii, Ranunculus pedatifidus *forb, grass tundra. This is an exceptionally rich site associated with fox and ground squirrel dens on a pingo near Frontier Camp.*

Figure 22. Coastal bluffs. Sandy beaches and low coastal banks with slumping peat mats are common in the vicinity of the West Dock.

ed from coastal bluffs (Fig. 22). The most exposed beaches are unvegetated. More stable sands contain open communities of *Puccinellia phryganodes, P. andersonii, Stellaria humifusa* and *Cochlearia officinalis* (Stand Type B8, Fig. 23). Offshore islands and some beaches have fine gravel where one can find communities composed almost exclusively of *Mertensia maritima* and *Honckenya peploides*.

Areas between the beaches and the upper strand line are frequently inundated with saltwater. Quiet lagoons and estuarine sites have a reddish-brown

Figure 23. Stand Type B8. Dry Cochlearia officinalis, Puccinellia phryganodes *forb, grass barren on a beach near West Dock. Note the peat blocks that have been washed onto the beach in the background.*

mat of vegetation composed mostly of *Carex subspathacea*. Other taxa include *Puccinellia phryganodes, Carex ramenskii* and *Cochlearia officinalis* (Stand Type M9, Fig. 24). Areas less frequently inundated include meadows with *Dupontia fisheri, Carex aquatilis, Eriophorum angustifolium* and *Cochlearia officinalis* (Stand Type U13). Strand line vegetation varies considerably but often includes *Poa arctica, Dupontia fisheri, Carex aquatilis, Salix planifolia* ssp. *pulchra, Saxifraga cernua, Petasites frigidus, Potentilla pulchella* and *Cerastium beeringianum*.

The vegetation along many bluff tops has been killed by saltwater inundation during storm surges. Most of these areas formerly had dry dwarf shrub tundra. Now there is virtually no live vegetation. *Dryas* and *Salix* are easily killed by saltwater (Simmons et al. 1983). Some dry salt-killed areas near the East Dock had virtually no vegetation in 1973. In 1980 these sites had an open cover of vegetation dominated by *Puccinellia andersonii*, with *Braya purpurascens, Fulgensia bracteata* and *Thamnolia subuliformis*. Some coastal dry bluffs, such as one near the mouth of the Little Putuligayuk River and east of the Central Compressor Plant, are high enough not to be affected by storm surges. These have distinctive communities of *Primula borealis, Braya purpuras-*

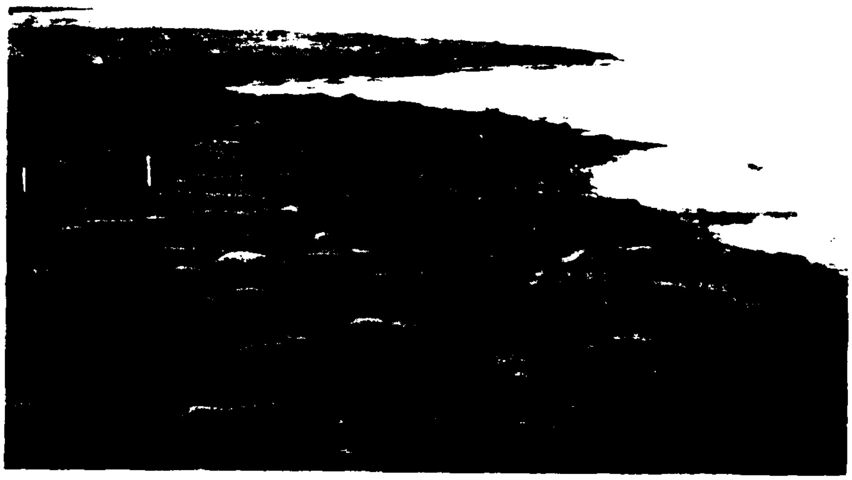


Figure 24. Stand Type M9. Wet Carex subspathacea, Puccinellia phryganodes *sedge tundra in a saltwater lagoon near the West Dock.*

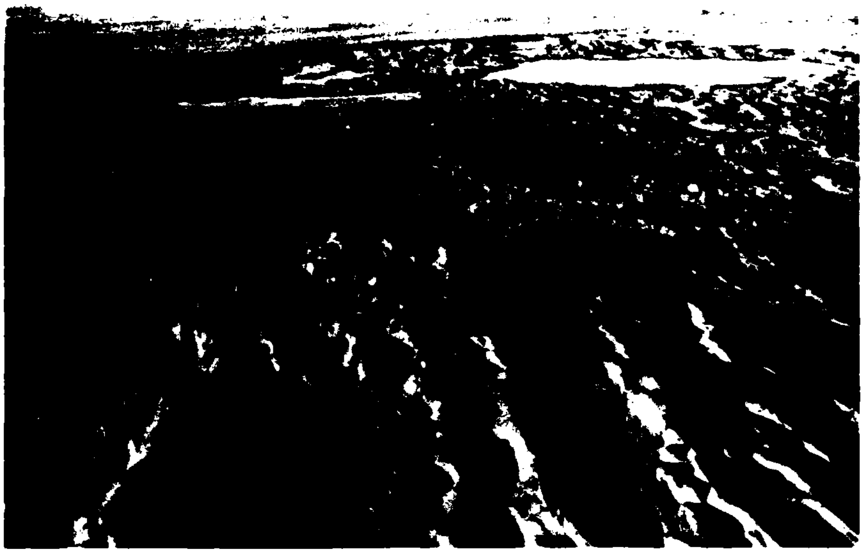


Figure 25. Longitudinal sand dunes near the mouth of the Sagavanirktok River. This view is toward the east, with longitudinal dunes oriented in the direction of the prevailing winds (toward the camera).

Figure 26. Stand Type B9. Dry Elymus arenarius, Dupontia fisheri *grass barren in the Sagavanirktok River dunes.*

cens, Salix ovalifolia, Artemisia arctica, Androsace chamaejasme, Oxytropis nigrescens, Potentilla pulchella, Dryas integrifolia, Saxifraga oppositifolia, Sedum rosea and *Draba alpina* (Stand Type B11).

Sand dunes

Dunes are common in the deltas of the Sagavanirktok and Kuparuk rivers. The Sagavanirktok dune field (Fig. 25) is fairly extensive and offers a striking contrast to the surrounding wet tundra. Most of the active dunes are longitudinal and strongly oriented in the direction of the prevailing winds, northeast to southwest. The most active dunes are sparsely vegetated with *Elymus arenarius* (Stand Type B9, Fig. 26). Slightly more stable dunes may include other taxa, such as *Dupontia fisheri, Polemonium boreale, Androsace chamae-*

Figure 27. Partially stabilized dune area dominated by Artemisia borealis, Deschampsia caespitosa, Trisetum spicatum *and* Salix ovalifolia.

Figure 28. Dunes encroaching on an area of low-centered polygons. Polygonal patterns are visible in the foreground beneath recently deposited eolian sands.

jasme, Draba lactea, D. cinerea, Artemisia glomerata, A. borealis and *Festuca rubra*. Sandy interdune areas often lack vegetation or contain scattered individuals of *Salix ovalifolia*. Some partially active dune areas contain extensive stands of *Artemisia borealis* mixed with grasses (Fig. 27). Dunes on the Kuparuk River sometimes also have the uncommon plant *Thlaspi arcticum*. Semistable areas are likely to have all the above plants plus others, such as *Salix ovalifolia, Dryas integrifolia, Parrya nudicaulis, Armeria maritima, Kobresia myosuroides, Oxytropis nigrescens, Distichium capillaceum* and *Ditrichum flexicaule*. Several areas, particularly in the delta of the Sagavanirktok River, have older dunes that are completely vegetated with Stand Type B1.

Polygonal areas west of the Sagavanirktok dunes receive abundant eolian material from the dunes (Fig. 28). There are fewer mosses on these polygon rims than on polygon rims elsewhere in the region. Important vascular taxa on these rims include *Carex aquatilis, Dryas integrifolia, Salix ovalifolia* and *Polygonum viviparum* (Stand Type U14). The basins of the polygons, in contrast, have thick moss carpets composed of *Drepanocladus brevifolius, Calliergon richardsonii, Cinclidium latifolium* and *Meesia triquetra*. The main vascular plants in these basins are *Carex aquatilis, Dupontia fisheri* and *Pedicularis sudetica* ssp. *albolabiata* (Stand Type M3). The difference in the moss cover on the basins and the rims causes very different thaw depths within the confines of single polygons. Thaw on the rims often exceeds 80 cm, while the thaw depth in the basins is usually less than 45 cm. Some areas of well-developed low-centered polygons have standing water all summer, and the ponds in the polygon basins are often over 1 m deep, with a thick carpet of the moss *Scorpidium scorpioides* (Stand Type E3).

Alluvial deposits

Vegetation associated with river systems is subject to intense disturbance during spring breakup. In addition the meandering streams and braided rivers are constantly changing their channels. The successive stages of vegetation associated with river systems range from barren river gravels to tundra that is indistinguishable from that in non-alluvial areas. The fact that all of the region is closely underlain by alluvial material that was once part of the ancient delta of the Sagavanirktok indicates that the present tundra surface is a stage in the successional history of riparian areas.

The first plants to colonize river gravels include *Epilobium latifolium* and *Artemisia arctica*. Slightly more stable areas are often only partially vegetated (Fig. 29) but may contain a wide variety of taxa, including *Artemisia glomerata, A. borealis, Papaver lapponicum, Anemone parviflora, Trisetum spicatum, Elymus arenarius, Wilhelmsia phy-*

Figure 29. Gravel river bars along the Little Putuligayuk River. Some of the more sparsely vegetated areas support Stand Type B4, Dry Epilobium latifolium, Artemisia arctica *forb barren.*

sodes, Astragalus alpinus, Braya purpurascens, Equisetum arvense, Parnassia kotzebuei, Saxifraga oppositifolia, Polemonium boreale, Salix ovalifolia, Festuca rubra, F. baffinensis, Cerastium beeringianum, Minuartia rubella, M. arctica, Erigeron eriocephalus, Aster sibiricus, Arabis lyrata ssp. *kamchatica* and *Antennaria friesiana* (Stand Type B4).

The richest sites in the Prudhoe Bay region are the partially vegetated river bars along the Kuparuk River. One small river bar near Service City (Fig. 3) contained 66 species of vascular plants, nearly a third of the flora for the entire region.

Table 4. List of taxa naturally colonizing an abandoned well site, BP Put. R. Well. This is one of the older wells in the region, probably drilled in 1968 or 1969, and has been one of the least disturbed since drilling.

Arctagrostis latifolia	*Epilobium latifolium**
Artemisia borealis	*Eutrema edwardsii*
Artemisia glomerata	*Festuca baffinensis*
Astragalus aboriginorum	*Lloydia serotina*
Astragalus alpinus	*Oxytropis nigrescens*
*Braya purpurascens**	*Papaver lapponicum*
Bryum spp.	*Parrya nudicaulis*
Cerastium beeringianum	*Polemonium boreale*
Draba alpina	*Saxifraga oppositifolia**
Draba lactea	*Trisetum spicatum*

* Particularly abundant taxa.

Many taxa have been found locally only on these river bars, including *Lupinus arcticus, Thlaspi arcticum, Pedicularis verticillata, Senecio hyperborealis, Arnica frigida, Castilleja caudata, Astragalus aboriginorum, Phlox sibirica, Potentilla biflora, Achillea borealis, Hedysarum alpinum* ssp. *americanum, Oxytropis campestris* ssp. *gracilis* and *Artemisia tilesii.* Somewhat more stable areas contain willows. The dominant willow is *Salix lanata* ssp. *richardsonii. Salix alaxensis, S. glauca* and *S. brachycarpa* ssp. *niphoclada* also occur, particularly somewhat inland south of Deadhorse and Service City. Information regarding the common plants on gravel bars could be very useful for predicting natural revegetation of gravel roads and pads. Some of the older abandoned pads in the region are naturally revegetating with many of the same taxa that grow in the river channels. Table 4 is a list of taxa occurring on one of the older pads in the region, BP Put. R. Well near pad Y (Fig. 3).

Smaller streams and quieter interchannel areas of the larger rivers have banks with lush *Carex aquatilis* stands (Stand Type M5, Fig. 30). Other taxa include *Eriophorum angustifolium, Salix arctica, S. rotundifolia, Saxifraga hirculus, Valeriana capitata, Cardamine pratensis, Dupontia fisheri, Catoscopium nigritum, Pohlia* spp., *Campylium stellatum, Cinclidium arcticum* and *Drepanocladus brevifolius.* Streambank areas farther inland (about 10 km from the coast) have well-devel-

Figure 30. Stand Type M5. Wet Carex aquatilis, Salix rotundifolia *sedge, dwarf shrub tundra along the banks of a small beaded side channel of the Kuparuk River.*

Figure 31. Stand Type U8. Moist Salix lanata, Carex aquatilis *dwarf shrub, sedge tundra along the Putuligayuk River near Pad B.*

Figure 32. Tundra stream near Prudhoe Bay. The margins paralleling the stream reflect the level of spring flooding.

oped stands of *Salix lanata* ssp. *richardsonii* intermixed with the plants of Type M5. These willow communities are designated Stand Type U8 (Fig. 31). The willows, however, rarely exceed 15–20 cm in height in streamside sites within the region.

Several streams, such as the Little Putuligayuk River and some tributaries of the Kuparuk River, have dry, sandy, well-vegetated streambanks. These have prostrate shrub communities (Stand Type B6) dominated by *Dryas integrifolia, Astragalus alpinus, Distichium capillaceum* and *Ditrichum flexicaule*, with numerous other taxa such as *Gentianella propinqua, Astragalus umbellatus, Parrya nudicaulis, Silene acaulis, Kobresia my-*

osuroides, Oxytropis borealis, Carex scirpoidea, Salix rotundifolia and *S. reticulata.* These areas contain very few lichens because they are removed by the spring floods.

Upland streambanks with dense, moist sedge vegetation resemble Type U3 except that, like Type B6, nearly all the fruticose lichens and prostrate dead vegetation are removed by the spring floods. These areas are designated Type U9. Usually they have a distinct moss component consisting of *Tomenthypnum nitens, Didymodon asperifolius, Tortula ruralis, Ditrichum flexicaule, Distichium capillaceum, Pohlia* spp. and *Drepanocladus uncinatus.* Figure 32 shows a typical tundra stream, with bands of vegetation associated with spring flooding.

AREAL ANALYSIS OF VEGETATION AND OTHER GEOBOTANICAL UNITS

The geobotanical maps of the region (Walker et al. 1980) are probably the most detailed maps for any large area in the Arctic (Fig. 33). Area analysis

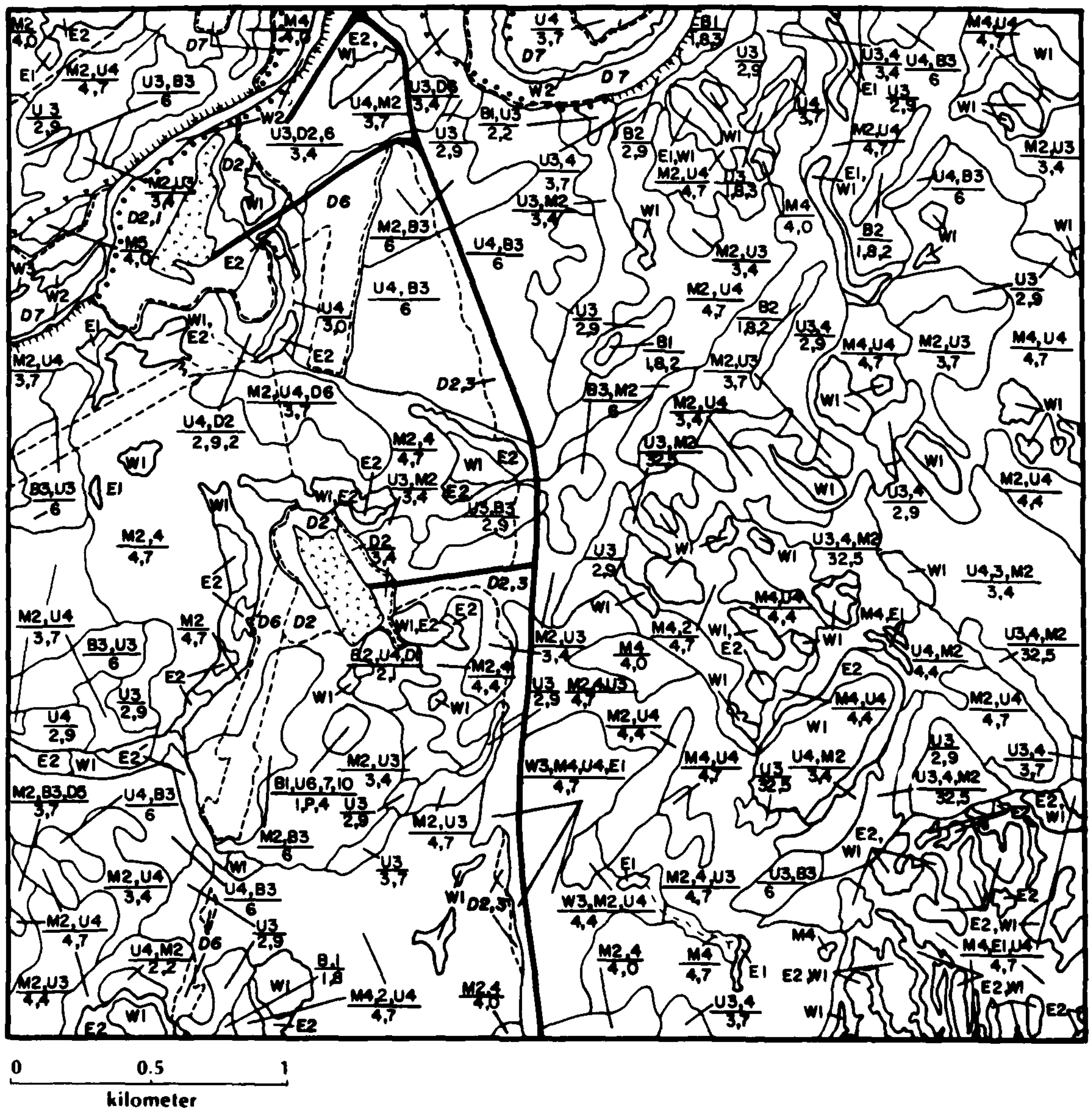


Figure 33. Example of a master map of the Prudhoe Bay IBP study area near the Putuligayuk River. The codes represent the vegetation (numerator, Table 3), soils (first code in denominator, Table 2), landforms (second code in denominator) and slope (third code in denominator).

of the maps (Table 5) provides much useful information that aids in characterizing the microrelief of the region. The maps cover a 140-km^2 swath through the principal area of development in a direction from southeast to northwest. There are four master maps, each covering an area of about 35 km^2. A separate analysis for each map gives a better idea of the differences between the eastern and western portions of the field (Fig. 34).

The maps do not cover any of the coastal or sand dune areas or the recently developed areas east of the Sagavanirktok River or west of the Kuparuk River. They are concentrated in the alkaline tundra area; only Map 4 has much acidic tundra on it. The maps do, however, cover most of the main area of development as of 1973, and they are representative of the terrain within the main oilfield.

The methods for making the maps are discussed in Everett et al. (1978) and Walker et al. (1980). The area measurements were done in the manner described by Komárková and Webber (1980) for the vegetation maps of Atkasook, Alaska. Each map unit was cut out with scissors. All map polygons with the same geobotanical code were weighed together on an analytical balance. The percentage area of a given code was calculated by dividing the weight of the total units for that code by the weight of the entire map.

The data in Table 5 refer to the dominant vegetation types. For example, the data for Type U3 include all the units where U3 is dominant, even though other vegetation types may occur within the same map unit.

Summary of the total mapped area

The most obvious conclusion to be drawn from the data is that the Prudhoe Bay region is indeed a wet environment. Lakes, streams, areas with emergent vegetation and areas flooded due to development (i.e. the sum of lakes, streams and map codes E1, E2, E3, E4, M4 and W3) covered 45% of the region in 1973. Flooded areas (Type W3) covered about 2.5% of the area at that time. The area covered by water has increased in the past several years because of additional roads and pads and the consequent flooding. No data are available to compare present flooding with that in 1973, but aerial photographs taken in 1973 and 1979 show an obvious increase in flooding. Lakes and rivers cover 25% of the region, and the remainder of the water-covered surfaces (about 17%) is covered by marsh and emergent vegetation (Stand Types M4, E1, E2, E3 and E4). Less than 1% of the region has dry tundra (Stand Types B1, B2 and B6). Moist tundra (Stand Types U1, U2, U3 and U4) covers about 19% of the region, and wet tundra (Stand Types M1, M2, M3, M4 and M5) covers about 43%. (Note that M4 was also counted with the water-covered surfaces since this type usually has standing water throughout the summer.) Units dominated by all other stand types, including frost scars, snow beds and streamside vegetation, account for less than 2% of the mapped area.

The soils also reflect the wetness of the landscape. Nearly 31% of the region is covered by a complex of wet Histic Pergelic Cryaquepts and Pergelic Cryofibrists (Soil Type 4). About 22% of the region has only somewhat better drained soils consisting of a complex of Histic Pergelic Cryaquepts, Pergelic Cryohemists and Pergelic Cryosaprists (Soil Type 3). Mollisols (Soil Types 1, 2 and 6) cover about 12% of the region, and the best-drained zonal soils, Cryoborolls (Soil Type 1), occupy less than 0.5%. Pergelic Cryorthents (Soil Type 5), associated with alluvial areas, cover about 3%.

The landform data show a predominance of wet terrain types. Low-centered polygons (Landform Types 3 and 4) cover about 21% of the region, and strangmoor or disjunct polygon rims (Type 7) cover about 22%. Featureless terrain (Type 0), commonly associated with drained lake basins, covers about 9% of the region. Well-drained landforms, including high-centered polygons, reticulate patterned ground and pingos, cover only about 8% of the region.

Disturbed sites cover a surprisingly large area: over 21 km^2, or 15% of the mapped area. This figure has probably increased substantially since 1973 due to numerous new roads and pads, pad expansions, increased gravel mining, and larger flooded areas.

Comparison of the eastern and western portions of the mapped area

The data from the individual maps reflect some noticeable differences between the eastern and western parts of the field. Maps 1 and 2 (Fig. 34) cover the eastern portion of the field adjacent to the Sagavanirktok River. Map 3 straddles the Putuligayuk River in the central part of the region, and Map 4 is on the western side of the field.

One of the most noticeable differences is the amount of water. Maps 1 and 2 have about 20% of their areas covered by lakes, whereas Map 4 has about 28% water. Another difference is in the dominance of low-centered polygons. In the eastern portion of the field, low-centered polygons

Table 5. Summary of area measurement data for the master maps of the Prudhoe Bay region (Walker et al. 1980).

	Map 1 area		Map 2 area		Map 3 area		Map 4 area		Total area = 140.9 km²	
	(km²)	(%)	(km²)	(%)	(km²)	(%)	(km²)	(%)	(km²)	(%)
Primary vegetation types										
B1	0.14	0.41	0.07	0.20	0.12	0.33	0.07	0.20	0.40	0.28
B2	0.07	0.20	0.04	0.10	0.15	0.42	0.18	0.50	0.44	0.31
B3	0	0	0.02	0.06	1.23	3.54	0.03	0.08	1.28	0.91
B4	0.04	0.11	0	0	0	0	0.04	0.10	0.08	0.05
B5	0.10	0.27	0.01	0.01	0	0	0.06	0.18	0.46	0.12
B6	0.06	0.18	0	0	0	0	0	0	0.06	0.04
U1	0	0	0	0	0	0	0.03	0.08	0.03	0.02
U2	0.50	1.41	0	0	0.24	0.68	1.22	3.42	1.96	1.39
U3	4.55	12.92	3.10	8.76	4.09	11.81	3.61	10.07	15.35	10.89
U4	1.15	3.28	2.58	7.31	3.06	8.83	2.12	5.92	8.91	6.32
U5	0	0	0.02	0.06	0	0	0	0	0.02	0.01
U6	0.01	0.01	0	0	0.01	0.02	0.03	0.07	0.05	0.04
U7	0	0	0	0	0	0	0.01	0.02	0.01	0.01
U8	0	0	0.02	0.07	0	0	0.01	0.03	0.03	0.02
U9	0.01	0.02	0	0	0	0	0	0	0.01	0.01
M1	0	0	0	0	0	0	6.54	18.24	6.54	4.64
M2	10.19	28.93	11.39	32.30	8.69	25.12	4.30	11.99	34.57	24.54
M3	0.81	2.29	0	0	0	0	0.01	0.04	0.82	0.58
M4	5.11	14.51	4.64	13.16	5.49	15.86	2.95	8.23	18.20	12.92
M5	0.06	0.18	0.15	0.43	0.08	0.22	0.19	0.52	0.48	0.34
E1	0.34	0.97	0.19	0.53	0.17	0.49	0.35	0.97	1.05	0.75
E2	1.01	2.89	1.12	3.18	0.47	1.37	0.97	2.71	3.57	2.53
E3	1.02	2.90	0	0	0	0	0	0	1.02	0.72
E4	0	0	0.01	0.01	0	0	0	0	0.01	0.01
Lakes	6.23	17.70	7.54	21.38	8.92	25.78	10.07	28.10	32.76	23.25
Streams	1.23	3.50	1.36	3.84	0.19	0.55	0.17	0.49	2.95	2.09
Barren areas										7.21
Total water-covered area (lakes + streams + E1 + E2 + E3 + E4 + M4 + W3) = 62.89 km² = 44.63%										
Soil types										
1	0.04	0.11	0.06	0.17	0.22	0.62	0.33	0.92	0.65	0.46
2	3.21	9.11	2.41	6.83	2.44	7.04	3.05	8.52	11.11	7.89
3	8.36	23.74	9.06	25.70	8.13	23.51	5.46	15.23	31.01	22.01
4	11.82	33.56	10.58	30.01	9.36	27.06	11.56	32.26	43.32	30.75
5	0.77	2.18	1.79	5.07	0.93	2.68	0.60	1.68	4.09	2.90
6	0.79	2.23	0.37	1.05	3.02	8.74	1.94	5.40	6.12	4.34
32	0.08	0.22	0.19	0.54	0.28	0.81	0.21	0.58	0.76	0.53
Landform types										
1	0.03	0.08	0.04	0.13	0.08	0.23	0.19	0.54	0.34	0.24
2	0.21	0.60	0.24	0.69	0.21	0.61	0.48	1.33	1.14	0.81
3	0.11	0.31	0.04	0.10	0.01	0.03	0.06	0.17	0.22	0.16
4	11.10	31.51	10.20	28.91	6.59	19.04	2.02	5.63	29.91	21.23
5	0.08	0.22	0.19	0.54	0.28	0.81	0.21	0.58	0.76	0.54
6	0.77	2.20	0.36	1.04	3.02	8.71	1.98	5.52	6.13	4.35
7	6.12	17.39	6.22	17.66	7.95	22.99	11.38	31.76	31.67	22.48
8	0.01	0.03	0.02	0.06	0.11	0.33	0.01	0.02	0.15	0.11
9	2.98	8.47	2.10	5.95	2.14	6.18	2.41	6.74	9.63	6.83
O	2.82	8.02	3.21	9.10	2.95	8.52	3.59	10.02	12.57	8.92
P	0.03	0.09	0.04	0.11	0.10	0.30	0.32	0.90	0.49	0.35
A	0.75	2.12	1.79	5.07	0.93	2.68	0.56	1.56	3.28	2.33
Primary disturbance types										
W3	0.86	2.43	0.89	2.51	0.49	1.42	1.09	3.04	3.33	2.36
D2	0.77	2.19	1.68	4.77	0.39	1.12	0.96	2.69	3.82	2.71
D3	0.05	0.14	0	0	0.60	1.74	0	0	0.65	0.46
D4	0.98	2.77	0	0	0	0	0	0	0.98	0.69
D5	0.05	0.15	0.06	0.17	0	0	0.15	0.41	0.26	0.18
D6	0.01	0.01	0	0	0.16	0.47	0.02	0.06	0.19	0.13
D7	0.66	1.86	1.71	4.85	0.90	2.62	0.23	0.64	3.50	2.48
Pads	2.03	5.77	0.98	2.79	1.81	5.23	1.07	2.98	5.89	4.18
Roads	0.91	2.59	0.48	1.35	0.58	1.68	0.59	1.64	2.56	1.81
Total disturbed areas = 21.18 km² = 15.00%										

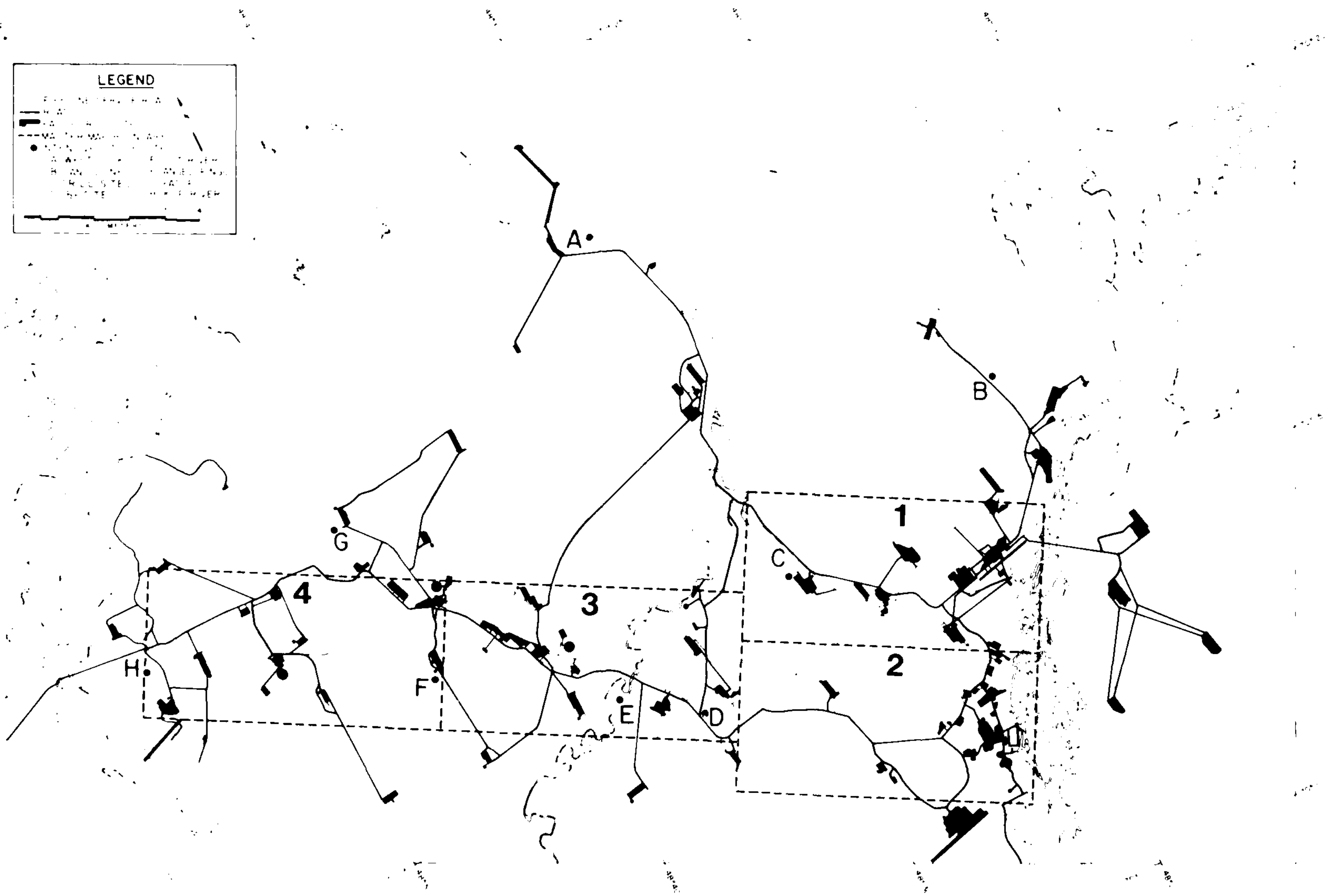


Figure 34. Location of study sites and master map areas.

cover about 32% of the area; on Map 4 they cover less than 6%. Strangmoor is more common in the western part, with 32% compared to 17% in the eastern part.

Bilgin (1975) noted a difference in soil texture across the region, with sandier soils occurring adjacent to both the Kuparuk and Sagavanirktok rivers and silty soils in the middle portions of the region. The same trends were noted in this study and are associated with loess from the Sagavanirktok River (see Chapter 4). The areas toward the east may be somewhat better drained because of the input of mineral loess. The surficial silt and peat deposits are substantially thinner toward the coast north of the Sohio Base Camp, indicating that this area may be a fundamentally different landscape with a different age than the areas toward the east.

Another indication of the different histories of the east and west portions of the field is the contrast in the pingos of the two areas. Several of the pingos toward the west are much larger and tend to be more gently sloped than the pingos in the eastern portion of the region. Michelle Pingo on Map 4 covers more area than all the other pingos in the mapped area combined. This pingo is quite broad with a gently sloping base, which contrasts with the small steep-sided pingos that predominate toward the east. Michelle Pingo, Angel Pingo and a few others in the western part of the mapped area are similar to pingos west of the Kuparuk River, where there is an extensive region of rolling topography caused by broad-based pingos.

Satellite imagery reveals that most of the area between the Kuparuk and Sagavanirktok rivers was part of an ancient flood plain of the Sagavanirktok River. The rolling area west of the river is probably older than this flood plain. East of the river the rolling topography has been leveled by fluvial processes. The most noticeable differences in the vegetation between the east and west ends of the field include 1) an increase in tussock tundra vegetation (Type U2) toward the west, 2) a decrease in wet alkaline tundra (Type M2), and 3) a corresponding increase in wet acidic tundra (Type M1). The present patterns of landforms and vegetation are thus intimately related to the history of the major rivers and the present distribution of loess. The details of the historical changes in the rivers are not known except for the points discussed above, which have been gleaned from the map information and aerial photographs. The loess gradient will be discussed in more detail in Chapter 4.

INFLUENCE OF MICROSCALE PATTERNS ON SOIL FACTORS AND INDIVIDUAL PLANT TAXA

The intent of the following analyses is to examine the effects of the microscale gradients on soil factors and the distribution of individual plant taxa. Simple correlation analysis was used to examine these patterns.

Vegetation mapping has been the major justification for these studies at Prudhoe Bay. From the outset it was assumed that distinct vegetation communities can be delineated. This is not, however, the consensus of all arctic ecologists. Many (including Griggs 1934, Raup 1941, 1965, Bruggemann and Calder 1953, Savile 1964) have found that arctic taxa have wide tolerances along several environmental gradients, and they feel that this makes a community approach to vegetation analysis very difficult. Griggs (1934) considered the ruderal quality of arctic vegetation to be so significant that it essentially prevents the description of arctic vegetation by means of floristically distinct units:

> In short every feature of arctic vegetation, the anomalies in the geographical distribution of arctic species, the occurrence of many species in all sorts of habitats, and their apparent indifference to the diverse conditions thereof, the lack of definiteness to the composition of the plant cover in any particular habitat, the physical instability of the ground itself, the general ruderal character of arctic vegetation, the large number of our weeds which are native to the arctic—all these testify to an instability in arctic vegetation very different from the relatively stable plant formations of the temperate zone (Griggs 1934, p. 174).

Others, however, have apparently had no more trouble describing communities in the Arctic than in temperate regions (Bocher 1963, Gjaerevoll 1950, 1954, 1956, 1967, Fredskild 1961, Rønning 1965, Lambert 1968, Barrett 1972, Racine 1975, Komárková and Webber 1980). Barrett (1972), discussing the vegetation of the Truelove Lowland, Devon Island, Canada, concluded:

> The synthesized units of classification [by Braun-Blanquet methods] appear by comparison to be as systematically substantial as those regularly described from the temperate regions. Ecotones are in most cases sharply defined in the field. Vegetational units show strong correlation with underlying soil type and units generally have characteristic combinations of species present. These features confirm the natural cohesiveness of the suggested units. Further, comparisons of similarity matrices and dendrograms, generated in a similar fashion for vegetation groups in other regions

(Dahl 1956; West 1966; Lambert 1968; Beil 1969) shows the Devon Island units maintain as high, and in some cases higher, unit integrity at the association level. These results tend to negate the thesis that special phytosociological techniques are required for the delineation of arctic vegetation (Barrett 1972, p. 212).

The intent here is not to rekindle a debate that has been thoroughly discussed elsewhere (Raup 1941, Drury 1956, Churchill and Hanson 1958) but to emphasize that any community approach must be based on an understanding of the behavior of individual taxa along controlling environmental gradients.

Methods

Field sampling

During 1974 and 1975 most of the vegetation mapping was done for the Prudhoe Bay atlas. The stand types that appear on the maps (Table 3) were designed to be readily recognizable in the field with a minimum of botanical training. This is important for the general usefulness of the maps as tools in planning. Later mapping programs have further simplified the mapping units specifically for photointerpretive mapping methods (Walker 1983, Walker and Acevedo, in prep.). The units were thus chosen somewhat subjectively, but they were based on considerable observation and preliminary sampling in the summer of 1973. These units later became the basis for the vegetation analysis of the region. In 1975 and 1976 permanent study plots were selected in each of the stand types. For the more important types, several plots were established. The plots were concentrated at several study sites to minimize the logistical problems involved in visiting all the plots. A total of 92 plots were established at 8 main sites (Fig. 34).

Field sampling basically followed the methods used by Webber (Webber 1971, 1978, Webber et al. 1980, Komárková and Webber 1980) at Baffin Island, Barrow and Atkasook. The plots were established in stands of homogeneous vegetation. The plots varied in size from 1 m^2 to 1000 m^2. Fifty-one of the plots were 10 m^2, the size accepted by Shimwell (1971) and others as optimum for graminoid communities. The 10-m^2 plots were organized according to the diagram in Figure 35. The shape of the plots, however, varied according to the area available. Plots on features such as polygon rims often had very irregular shapes.

Data collected from each plot included the estimated percentage cover of all vascular plants, bryophytes and lichens. Several site factors, such as moisture, snow, frost activity and animal activity, were rated according to subjective environmental gradient scales (Table 6). Other site factors, such as depth of thaw, depth of water, and size of mi-

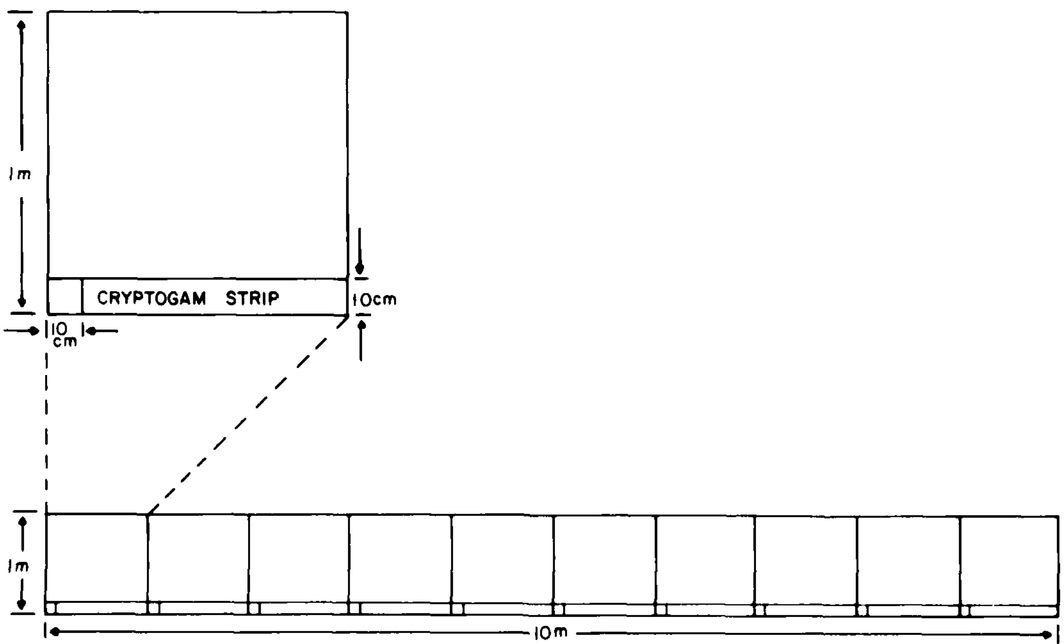


Figure 35. Layout of 10-m^2 study plots. The percentage cover was estimated for all vascular plants in each of the ten 1-m^2 areas. The presence of cryptogams was recorded in the 10- × 100-cm strip, and cryptogam cover was estimated for each of the 10- × 10-cm squares.

Table 6. Summary of environmental data recorded for each study plot.

Variable	*Abbreviation*	*Units*
Site variables		
Plot number	PLOTNUM	
Plot location	LOCATN	1) IBP site, 2) Putuligayuk River site, 3) Angel Pingo, 4) Kuparuk River dunes, 6) Coastal site, 7) Pad F site, 8) Drill site 2
Temperature regime	TEMPREG	3-point subjective rating scale: 1) Coastal, July mean < 4°C 2) Somewhat inland, July mean 4-7°C 3) Farther inland, July mean > 7°C
Moisture regime	MOISREG	5-point subjective rating scale: 1) Xeric, little moisture near the surface, exposed sites 2) Xero-mesic, moist soils, less-exposed well-drained sites 3) Mesic, moist to wet soils, moderately well drained sites 4) Hydro-mesic, wet soil continually saturated 5) Hydric, standing water all summer
Snow regime	SNOWREG	5-point subjective rating scale: 1) Very exposed site, very slight snow accumulation 2) Slightly exposed, with less than average snow accumulation 3) Average site, moderate snow accumulation 4) Moderate snowbank area, accumulation probably less than 2 m 5) Deep snowbank, more than 2 m of snow
Cryoturbation regime	CRYOREG	4-point subjective scale: 1) No surface evidence of frost-active soil 2) Some evidence (exposed plant roots, bare soil, etc) of frost-active soil on less than 5% of the surface 3) Much evidence of fr activity on 5-30% of the surface 4) Considerable evidence on more than 30% of the surface
Vegetation code	VEGTYPE	Walker and Webber (1980)
Topographic feature	TOPOFEA	1) Top of high-centered polygon, 2) Side of pingo, 3) Flat upland, 4) Polygon basin, 5) Polygon rim, 6) Lake or pond margin, 7) Drained thaw lake, 8) Lake or pond, 9) Base of pingo (level), 10) Level creek bank, 11) Sloping creek bank, 12) Flat with aligned hummocks, 13) Frost scar, 14) Pingo top, 15) Bird mound, 16) River terrace, 17) Slumping river bluff, 18) Active sand dune, 19) Stable sand dune, 20) Coastal bluff, 21) Estuary or lagoon, 22) Polygon trough, 23) Aligned hummock, 24) Gravel bar, 25) Lowland with frost scars
Slope inclination	SLOPE	Estimate: 0) 0-1°, 1) 1-3°, 2) 3-5°, 3) > 5°
Mean hummock height	HUMMOCK	1) 1-3 cm, 2) 3-10 cm, 3) 10-20 cm, 4) 20 cm
Slope aspect	ASPECT	0) Flat, 1) North, 2) East, 3) South, 4) West
Bare soil cover	SOILCOV	%
Rock cover	ROCKCOV	%
Water cover	H20COV	%
Depth of thaw	THAW77	Mean of 10 measurements, 15 August 1977 (cm)
Water depth	H20DEP	Mean of 10 measurements, 15 August 1977 (cm)
Marl surf. cover	MARL	%
Crustose lichen cover	CLICCOV	%
Foliose and fruticose lichen cover	FLICCOV	%
Bryophyte cover	BRYOCOV	%
Erect dead vegetation cover	ERECDED	%
Prostrate dead and litter cover	PROSDED	%
Plot size	PLOTSIZE	1) 10 m², 2) 1 m², 3) Undefined

Table 6 (cont'd).

Variable	*Abbreviation*	*Units*
Distance to Sagavanirktok River	SAGDIS	km
Distance to the coast along the N75°E direction	WDIST	km
Animal variables*		
Caribou	CARFECE	Caribou feces
	CARGRAZ	Evidence of caribou grazing
Brown lemming	BRWNLEM	Brown lemming sign (nest, runways or feces)
Collared lemming	COLLLEM	Collared lemming sign (nest or feces)
Birds	MISBIRD	Miscellaneous bird sign (feathers, feces etc.)
Fox	FOX	Fox sign (tracks, feces, bones, fur etc.)
Ptarmigan	PTARMIG	Ptarmigan sign (feces or feathers)
Goose	GOOSE	Goose sign (feces or feathers)
Ground squirrel	SQRRL	Ground squirrel sign (den, feces, tracks etc.)
Bear	BEAR	Bear sign (diggings in squirrel mounds)
Physical factors		
Soil moisture	SMOIS77	15 August 1977 (%)
Bulk density	BDEN77	15 August 1977 ($g\ cm^{-3}$)
Sand	SAND	%
Silt	SILT	%
Clay	CLAY	%
Field capacity	FLDCAP	% at ⅓ bar
Wilting point	WILTPT	% at 15 bar
Hygroscopic moisture	HYGMOIS	%
Available water	AVH20	%
Water absorption	H20ABSN	%
Organic matter	ORGMAT	%
Chemical factors		
Soil pH	PH	
Ammonium	NH4	Mass concentration (ppm)
Nitrate	NO3	Mass concentration (ppm)
Carbonate	CO3	Mass concentration (%)
Phosphorus	P	Mass concentration (ppm)
Potassium	K	Mass concentration (ppm)
Calcium	CA	Mass concentration (ppm)
Magnesium	MG	Mass concentration (ppm)

* All animal variables were recorded as frequency. In 10-m^2 plots this was the fraction (0.1 to 1.0) of occurrence in ten 1-m^2 subplots. In 1-m^2 plots presence was recorded as 1.0.

crorelief, were measured directly. Several 10- × 10-cm moss samples, two 300-cm^3 cans of soil for bulk density and soil moisture determinations, and a grab sample of soil from the root zone (10 cm deep) were collected for laboratory analysis. Voucher collections were made for unknown plants. A few problems arose due to misidentified taxa. Most of these have been noted in the annotated checklist of plants (Appendix A).

Soil analysis

Two 300-cm^3 cans of soil were removed from each plot. To avoid compression of the sample in peaty soils the peat was carefully cut around the perimeter of the cans with a knife as they were inserted in the soil. The sealed cans were later weighed, oven-dried at 105°C, and then reweighed to determine the amount of water in the sample. Soil moisture was recorded as the percentage of the mass of the dry soil. Bulk density was calculated as the weight of the dry soil divided by the volume of the can.

The fraction of the soil greater than 2 mm was collected in graduated sieves and expressed as a percentage of the total air-dried sample. The analysis for the fraction less than 2 mm (sand, silt and clay) utilized the pipette method and the USDA scale for particle sizes.

To determine the percentage of organic matter, the sample was placed in a porcelain crucible and heated to 400°C for 5 hours. The loss in weight of the sample was expressed as a percentage of the original weight of the soil.

Soil water retention was measured at 15 bars to determine the wilting point and ⅓ bar to determine the field capacity. Available water was calculated as the difference between the field capacity and the wilting point. Total water absorption was determined by placing the sample in a small can with a sieve bottom in a tray with a thin water layer, allowing the sample to absorb water until saturated. The total absorbed water was expressed as a percentage of the oven-dried weight.

The pH was based on a soil-water ratio of 1:2.5 by volume and was measured with a combination electrode on a Photovolt pH meter. Carbonates were determined using the gasimetric approach. The method utilizes a Chittick or baking soda apparatus that measures the volume of CO_2 liberated from a given mass of soil when HCl is added to the sample.

The soil nutrients were calculated on the basis of parts per million of oven-dried soil and represent the total available nutrients. The analyses were performed at the Palmer Plant and Soils Laboratory. Phosphorus was analyzed using the Olsen method for alkaline and neutral soils and the Bray 1 method for acidic soils. The extracting solution for neutral and alkaline soils was 0.5 N $NaHCO_3$ (pH 8.5); for acidic soils it was 0.025 N HCl in 0.03 N NH_4F (pH 2.6 ± 0.05). The analysis of the extract utilized the Technicon Autoanalyzer industrial method No. 94-70W (orthophosphate in water and wastewater). Nitrogen was analyzed with an extracting solution of 2N HCl and utilized the Technicon Autoanalyzer industrial method No. 100-70W for NO_3 and No. 98-70W for NH_4. Potassium, calcium and magnesium were extracted with 99.5% NH_4OAc and analyzed with an atomic absorption spectrophotometer.

Data analysis

Data from the permanent study plots were organized into an SPSS system file (Nie et al. 1975). The file consisted of two subsets of information for 92 study plots. The first part contained environmental data for 58 variables, and the second part contained percentage cover data for 252 taxa that occurred in the plots. A few of the variables were not continuous, although all were at least ordinal. Since most correlation analyses require continuous variables with normal distributions, these assumptions were not consistently met. Although the statistical treatments sometimes violated one or more assumptions of the analysis, no obvious, ecologically meaningful errors were detected in the results. However, the results can be interpreted only broadly and could be the basis for more definitive experiments. The objective here is not to define the exact tolerances for each taxon along each environmental gradient, but instead to use the analyses in conjunction with field experience to arrive at meaningful conclusions about vegetation–environment interactions.

Results and discussion

Relationship of soil to site

Soil moisture is linked to an array of site factors including soil texture, percentage of organic matter, pH, thaw depth and cryoturbation. It is virtually impossible to isolate the effects of soil moisture alone since nearly every component of the ecosystem appears to be either directly or indirectly influenced by it. Soil moisture, in turn, is primarily controlled by drainage characteristics related to microrelief. Another important cause of soil variation in the Prudhoe Bay region is the dilution of organic matter in the soil due to the input of wind-blown silts. This will be discussed more thor-

oughly in the next chapter. The objective here is to examine some of the complex effects of the site moisture gradient independent of the loess gradient. It would be best to examine the acidic tundra areas first since the effects of loess are at a minimum there. Most of the data, however, are from the alkaline areas, so this discussion applies mainly to these areas, which will later be contrasted with the acidic tundra.

Soil moisture. The various stand types were separated into 12 ecologically meaningful groups for analysis (Table 7). Table 8 summarizes the soil data for these ecological groups. This information is more comprehensible in graph form (Fig. 36–42).

Table 7. Ecological groups of vegetation types used in the analyses.

Ecological group	*Stand types*
Dry alkaline tundra	B1, B2
Moist alkaline tundra	U2, U3, U4
Wet alkaline tundra	M2, M3, M4, M11
Aquatic tundra	E1, E2, E3
Dry acidic tundra	B15, B12
Moist acidic tundra	M1, M8, M10
Wet acidic tundra	U1, U12
Frost scars	B3
Streamside sites or dunes	B4, B5, B6, B7, B9, B13, U8, M5, M6, M7
Animal dens or bird mounds	U10
Snow patches	U6, U7, B14
Estuaries or beaches	U13, M9, B8

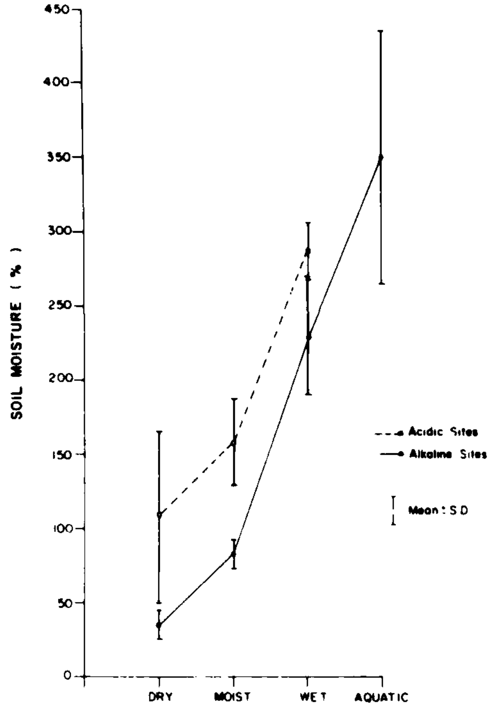


Figure 36. Measured soil moisture vs subjective site moisture regime classes. Alkaline and acidic tundra are portrayed separately.

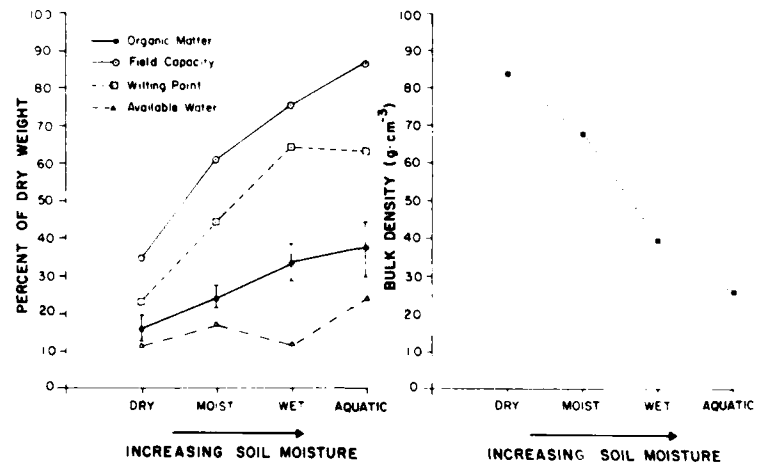


Figure 37. Moisture-related physical soil characteristics vs site moisture regime for alkaline study plots. Standard error bars are shown for organic matter; refer to Table 8 for standard deviations of the other parameters.

Figure 36 shows the relationship between the subjective moisture regime categories and the actual measured soil moisture. The higher soil moisture in the acidic types is due mainly to the greater percentage of organic matter in these soils; this will be discussed more thoroughly in the next chapter.

There are numerous effects of soil moisture on the physical characteristics of the soil. The most significant is the increase in the percentage of organic matter with higher soil moisture (Fig. 37). Dry alkaline sites had 14.7% organic matter compared to wet sites with 33.0%. This difference in organic matter is largely responsible for the major differences in other physical characteristics of the soils. For example, bulk density dropped from 0.84 g cm^{-3} in the dry sites to 0.26 g cm^{-3} in emergent sites. There is a corresponding increase in the water retention capability of the soil, as evidenced by the graphs of field capacity, wilting point, available water and hygroscopic moisture (Fig. 37).

Table 8. Soils data for the ecological groups of study plots.

PHYSICAL PARAMETERS

	Sand (%)			Silt (%)			Clay (%)			Organic matter (%)			Soil moisture (%)			Bulk density (g cm^{-3})		
Ecological group of plots	$\bar{x}$	S.D.	N	$\bar{x}$	S.D.	N	$\bar{x}$	S.D.	N	$\bar{x}$	S.D.	N	$\bar{x}$	S.D.	N	$\bar{x}$	S.D.	N
Dry alkaline tundra	53.2	29.7	3	31.8	23.5	3	15.1	7.3	3	14.7	12.7	8	34	24	8	0.84	0.28	8
Moist alkaline tundra	18.4	12.8	11	60.8	8.9	11	20.8	10.7	11	23.9	12.8	17	82	41	17	0.68	0.22	17
Wet alkaline tundra	31.8	29.8	11	51.2	26.2	11	17.0	7.9	11	33.0	20.4	15	228	164	15	0.39	0.24	15
Aquatic tundra	20.1	13.4	3	40.6	10.1	3	39.3	19.7	3	36.6	22.1	7	349	209	6	0.26	0.19	6
Dry acidic tundra	64.8	39.5	2	15.4	15.9	2	19.9	23.6	2	50.2	28.6	2	110	86	2	0.51	0.28	2
Moist acidic tundra	36.8	43.1	4	32.1	21.8	4	31.1	27.6	4	50.9	10.2	6	159	76	6	0.46	0.37	6
Wet acidic tundra	43.1	35.4	4	35.4	26.5	4	21.4	19.6	4	55.5	9.9	6	290	51	6	0.25	0.05	6
Frost scars	26.5	0	1	50.9	0	1	22.6	0	1	13.4	11.3	3	38	39	3	1.19	0.50	3
Streamside sites or dunes	51.5	18.1	9	37.3	15.3	9	11.2	4.0	9	5.7	3.9	11	25	23	12	1.10	0.22	12
Animal dens or bird mounds	51.8	0.1	2	30.9	0.1	2	17.2	0.1	2	31.6	12.6	4	65	50	4	0.54	0.15	4
Snow patches	20.2	4.2	2	63.8	4.0	2	16.0	0.3	2	20.5	11.0	5	63	28	5	0.66	0.15	5
Estuaries or beaches	68.5	18.8	4	21.6	16.2	4	9.9	3.0	4	34.3	18.7	4	124	56	4	0.54	0.29	4
All groups combined	37.8	27.3	57	43.4	21.5	57	18.8	13.2	57	28.0	20.0	89	130.5	135.6	89	0.63	0.36	89

CHEMICAL PARAMETERS

	pH			CO_3 (%)			NH_4 (%)			NO_3 (ppm)			P (ppm)			K (ppm)		
Ecological group of plots	$\bar{x}$	S.D.	N	$\bar{x}$	S.D.	N	$\bar{x}$	S.D.	N	$\bar{x}$	S.D.	N	$\bar{x}$	S.D.	N	$\bar{x}$	S.D.	N
Dry alkaline tundra	7.5	0.4	8	10.5	8.3	8	11.1	3.3	8	15.2	0.6	8	14	8	8	336	212	8
Moist alkaline tundra	7.3	0.5	17	14.2	10.3	17	12.3	4.4	15	10.4	3.2	15	9	6	15	299	62	15
Wet alkaline tundra	7.1	0.8	15	14.4	0.1	15	17.9	9.3	13	12.7	4.3	13	9	4	13	317	175	13
Aquatic tundra	6.9	0.8	7	10.9	12.9	7	23.2	11.8	5	8.1	2.2	5	5	5	5	205	163	6
Dry acidic tundra	5.2	0.4	2	0.1	0.1	2	12.7	0	1	14.3	0	1	3	0	1	349	0	1
Moist acidic tundra	5.6	0.6	6	0.4	0.4	6	19.5	5.8	5	14.4	7.0	5	3	2	5	252	79	5
Wet acidic tundra	5.7	0.4	6	0.4	0.5	6	13.7	2.1	5	11.9	1.8	5	2	1	5	241	72	5
Frost scars	7.4	0.6	3	19.5	19.2	3	8.7	1.4	3	7.2	2.8	3	5	5	3	125	79	3
Streamside sites or dunes	7.8	0.3	11	13.8	12.2	11	11.6	4.0	10	7.4	3.9	10	3	5	10	129	164	10
Animal dens or bird mounds	7.2	0.5	4	6.8	9.0	4	15.4	3.2	4	14.9	4.4	4	15	8	4	272	106	4
Snow patches	7.4	0.1	5	14.9	9.4	5	10.5	2.5	5	12.7	4.9	5	12	5	5	303	89	5
Estuaries or beaches	6.9	0.8	4	7.1	11.9	4	18.3	0	1	5.0	0	1	0.1	0	1	92	0	1
All groups combined	7.05	0.86	89	11.2	11.0	89	14.3	6.7	76	11.9	6.5	76	7.6	6.6	77	257	162	77

The organic matter also affects the soil's insulating properties, which has important implications for thaw depth. Bilgin (1975) measured the seasonal progression of thaw in several soils along a moisture catena. He measured thaw depths exceeding 95 cm by the end of August in sandy upland tundra soils. In contrast, wet soils high in organic matter had less than 30 cm of thaw. Thaw in most mineral soils proceeded evenly throughout the season, with the rate of increase gradually tapering off toward the end of August. Soils with buried organic layers, however, showed a nonuniform increase in thaw, slowing down as the thaw approached the buried layer.

A stepwise regression model based on Bilgin's data shows that thaw depth depends on four main factors. Three have a negative effect. They are, in order of the magnitude, 1) depth of the moss layer, 2) percentage of organic matter, and 3) soil texture (surface area of the particles). Slope has a net positive effect on thaw. Bilgin's regression equation accounts for 71% of the variation with these

Field capacity (%)			*Wilting point (%)*			*Available H_2O (%)*			*Hygroscopic moisture (%)*			*Water absorption (%)*		
$\bar{x}$	*S.D.*	*N*	$\bar{x}$	*S.D.*	*N*	$\bar{x}$	*S.D.*	*N*	$\bar{x}$	*S.D.*	*N*	$\bar{x}$	*S.D.*	*N*
34.5	27.2	8	23.1	18.2	8	11.4	9.6	8	2.9	2.5	8	84.5	41.5	8
60.9	25.6	16	43.7	21.6	16	17.2	8.2	16	4.2	2.2	17	144.7	55.2	16
75.1	34.9	14	63.6	33.3	14	11.5	5.6	14	4.7	2.9	15	221.9	88.8	14
85.8	51.5	7	62.4	47.9	7	23.4	13.3	7	5.4	3.3	7	256.4	190.3	7
91.5	39.5	2	69.4	38.1	2	22.2	1.4	2	6.3	1.5	2	169.8	87.4	2
92.3	18.8	6	61.1	17.2	6	23.6	13.7	6	7.4	1.7	6	181.0	40.4	6
107.3	11.2	6	83.7	16.0	6	31.3	6.8	6	7.6	1.2	6	277.8	60.6	6
40.9	28.0	3	18.7	14.8	3	21.8	13.4	3	2.7	2.2	3	72.5	30.7	3
16.6	11.2	10	10.5	8.3	10	5.9	3.3	10	1.1	0.7	11	57.7	26.9	10
63.0	18.3	4	47.8	15.4	4	15.2	7.9	4	5.3	2.5	4	146.1	35.6	4
48.1	18.0	5	32.2	13.6	5	15.9	7.5	5	4.0	2.5	5	113.9	24.8	5
17.9	0	1	12.6	0	1	5.3	0	1	3.4	1.9	4	69.7	0	1
61.5	37.3	83	45.3	31.9	83	16.2	10.5	83	4.3	2.8	89	157.5	100.9	83

Total Ca (ppm)			*Total Mg (ppm)*		
$\bar{x}$	*S.D.*	*N*	$\bar{x}$	*S.D.*	*N*
5438	2203	8	300	234	8
6065	1829	15	233	152	15
5316	2024	13	314	337	13
5179	2524	6	296	292	6
3648	0	1	627	0	1
5557	2728	5	424	158	5
5514	885	5	406	249	5
4542	2367	3	371	285	3
2180	1154	10	93	47	10
7381	1839	4	466	270	4
6412	1648	5	246	150	5
1399	0	1	286	0	1
5113	2294	77	289	235	77

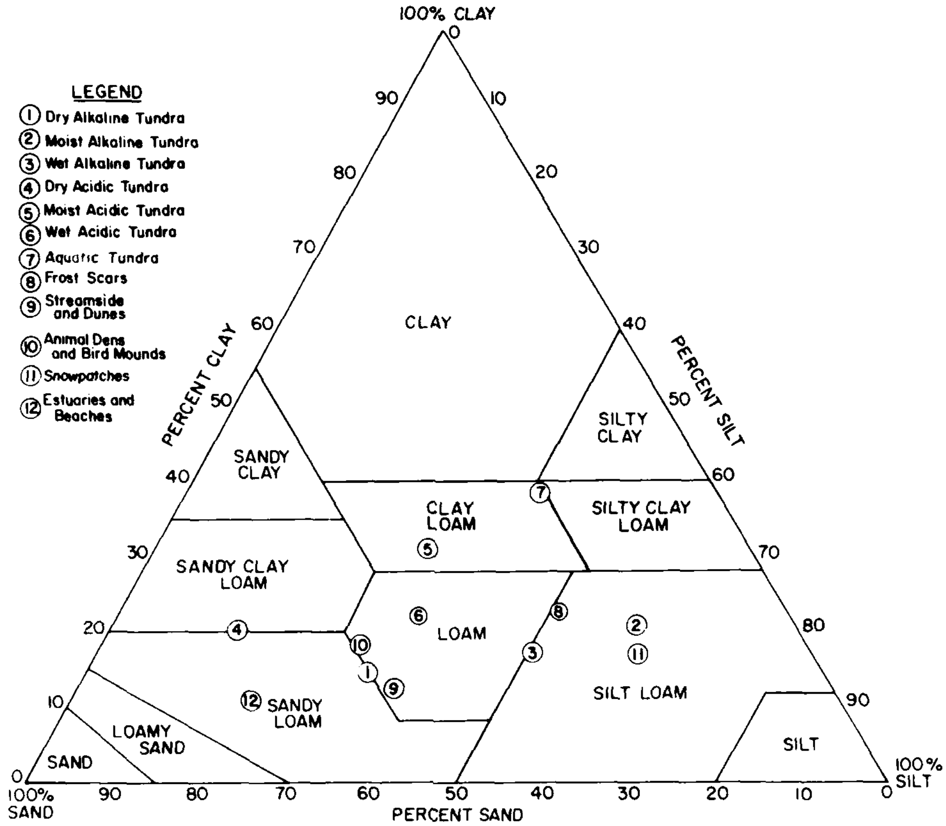


Figure 38. Soil textures for ecological groupings of study plots. Refer to Table 8 for standard deviations.

four factors. He did not consider the effects of temperature, which is necessary at Prudhoe Bay because of the steep temperature gradient associated with the coast. This will be discussed further in the next chapter.

A similar correlation analysis performed with the environmental parameters of this study showed that the following parameters were correlated with thaw depth at the 0.001 significance level (in the order of highest Pearson's R values): 1) organic matter, 2) slope, 3) percentage of bare soil, 4) percentage of soil moisture, 5) percentage of bryophyte cover, 6) temperature regime and 7) percentage of prostrate dead vegetation. Factors correlated at the 0.05 level were 1) clay, 2) percentage of erect dead vegetation and 3) sand.

Most of the Prudhoe Bay soils have high percentages of silt and fine sand and are classified as silt loams, loams or fine sandy loams (Fig. 38). The silts and sands at Prudhoe Bay differ from the Barrow soils, which have more clay (Gersper et al. 1980). The coarser particle sizes are due mostly to the wind-blown materials from the Sagavanirktok River. The drier soils tend to have a higher percentage of sand, which increases their permeability and drainage.

Soil moisture has surprisingly little effect on pH in the alkaline tundra areas (Fig. 39). There is a general decline of soil pH from 7.5 in the dry sites to 7.1 in the wet sites. The value for all emergent sites combined is 6.9.

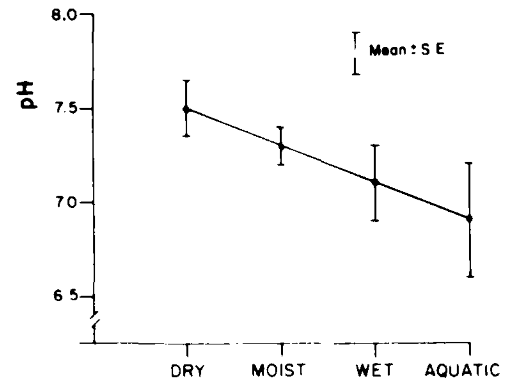


Figure 39. Soil pH vs site moisture regime. Data exclude plots in nonemergent acidic tundra areas.

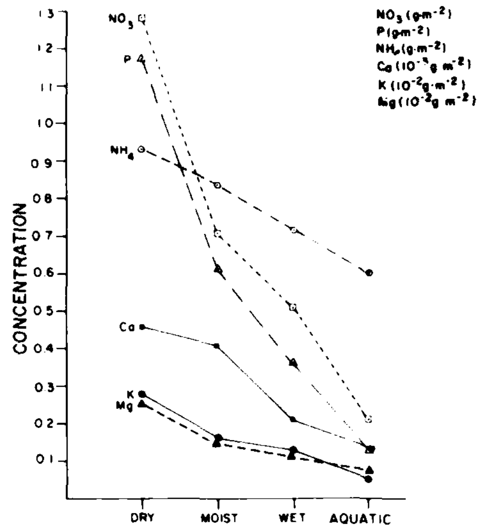


Figure 41. Soil chemical parameters (g m^{-2}) vs site moisture regime. Refer to Table 8 for standard deviations.

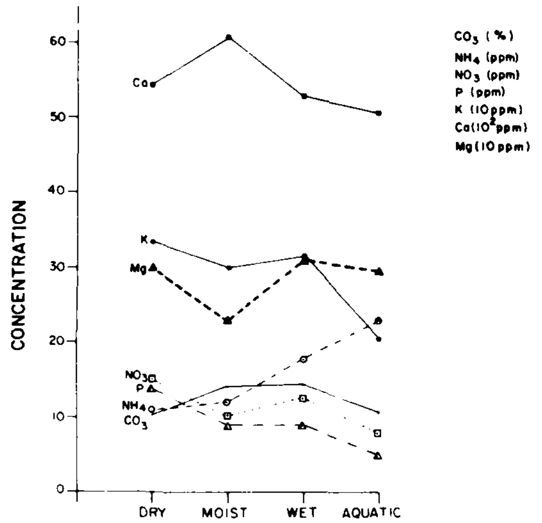


Figure 40. Soil chemical parameters (ppm) vs site moisture regime. Refer to Table 8 for standard deviations.

Nutrients. The relationships between soil moisture and total nutrients are less distinct. The dry sites, however, do have generally higher concentrations of total nutrients (on a parts per million basis) than do the wetter sites (Fig. 40). This is particularly true for NO_3, P and K, which have all been shown to be limiting to the Prudhoe Bay vegetation.* This contrast is even more dramatic if the nutrients are considered on the basis of mass per square meter in the upper 10 cm of soil (Fig. 41). This emphasizes the difficulty of comparing nutrient regimes between organic and mineral soils.

The higher concentrations of nutrients in drier sites is in agreement with the work of Gersper et al. (1980) at Barrow. An important consideration in the dry sites, however, is whether or not the soil is a mineral soil. Sites on most pingos and along many river systems are mineral (Cryoborolls), but other dry sites, particularly in systems of high-centered polygons, have highly decomposed organic soils (Cryosaprists). These latter soils are richer in nutrients than the mineral soils. Gersper et al. (1980) noted the strong correlation between organic carbon content and cation exchange capacity (CEC) in the Barrow soils; they stated that the relative degree of decomposition of the organic matter plays an important role:

> In general, poorly decomposed fibric organic matter contains relatively few phenolic hydroxyl

*Personal communication with J. McKendrick, Palmer Research Center, University of Alaska, 1977.

and carboxyl groups, and thus contributes comparatively little CEC to soil horizons in which it occurs. On the other hand, well humified sapric organic matter generally contains many such groups, and in many of the soils may be the main source of CEC. (Gersper et al. 1980, p. 227.)

This explains why the drier organic soils tend to have higher nutrient levels and why the Cryofibrists are likely to be relatively poor in nutrients, even though they are often higher in total organic matter. Another contributing factor is that the organic particles in the sapric materials are much smaller than in fibric materials.

Gersper et al. (1980) also made an important point regarding the effects of plant productivity on the cation concentrations of the soil solution (in contrast to the exchangeable pool discussed above). Generally high soil solution concentrations occur in sites with low plant productivity such as polygon basins and tops of high-centered polygons; sites with high productivity have low concentrations. The plants apparently draw on the soluble source, reducing the concentration dramatically. The soluble fraction also fluctuates considerably in response to thaw, precipitation, evapotranspiration, surface and subsurface flow, nutrient uptake by roots, and microbial activity (Gersper et al. 1980).

Nutrient concentrations vary considerably according to microsite. Gersper's work at Barrow showed major fluctuations within systems of low-centered polygons and is probably the best work to date regarding the responses of nutrients to microtopographic variations in arctic ecosystems. No comparable work is available from Prudhoe Bay, but some statement can be made regarding nutrients on a slightly smaller scale. The data already presented (Fig. 40 and 41) show nutrient variations along the generalized moisture gradient, and Figure 42 illustrates the variation in nutrients among the ecological groups of study plots. Each nutrient is discussed separately below.

Carbonate concentrations are high in all the alkaline Prudhoe Bay soils, ranging up to 39.3% by weight in a frost scar soil. The highest concentra-

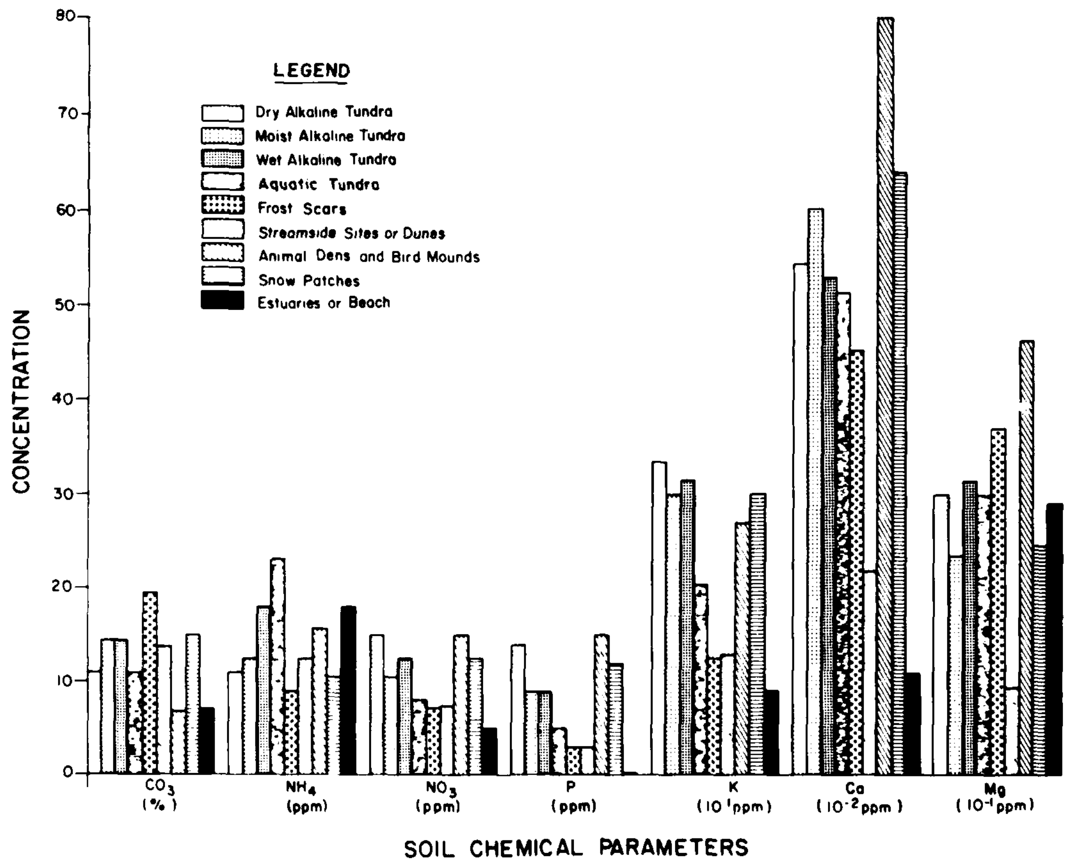


Figure 42. Carbonates and soil nutrients vs ecological groupings of study plots. Refer to Table 8 for standard deviations.

tions are found in frost scars, snow patches, streamside sites, and moist and wet tundra. The lowest concentrations are associated with animal dens and estuaries. The high concentrations are due to loess deposited from the Sagavanirktok River and to carbonate-rich parent material associated with the extensive alluvial deposits that underlie most of the region.

Ammonium concentrations are highest in wet tundra and in estuarine microsites. Relatively low values are found in frost scars, snowbanks and dry tundra. If considered on a gram per square meter basis (Fig. 41), the ammonium concentrations are somewhat greater in the dry sites. The ammonium concentration ranges from 6.6 ppm in a moist low-centered polygon basin near Drill Site 2 to 40.1 ppm in an emergent *Scorpidium* community.

The pattern for nitrates is nearly opposite to that of ammonium. Dry tundra sites, animal dens and snowbanks have the highest levels. The lowest levels are found in estuaries, frost scars, dunes and wet tundra. This is in agreement with the work of Bilgin (1975) and Gersper et al. (1980). Bilgin found that well-drained soils contribute more nitrate nitrogen and that poorly drained soils contribute more ammonium nitrogen to the regional surface waters. Gersper et al. found that the ratio of ammonium to nitrate in the soil solution changed from 10:1 in a moist meadow to 0.1:1 on a relatively dry polygon rim. Total nitrates at Prudhoe Bay varied from 4.3 ppm on a stabilized sand dune to 40.0 ppm on an organic-rich high-centered polygon.

Phosphorus follows a pattern similar to that for nitrates. The highest values are associated with bird mounds, dry tundra and snowbanks. Extremely low values are found in estuarine sites. Low values are also found in dunes, frost boils and wet tundra. Bilgin (1975) commented on the role of high soil pH. In the range of pH values above 7.5, phosphates precipitate in a relatively insoluble form with calcium and iron. Low total phosphorus of less than 0.1 ppm was found in sandy sites near the dunes, along the Kuparuk River, and in an estuary at the mouth of the Little Putuligayuk River. The highest value, 31 ppm, occurred on a high-centered polygon.

Potassium also follows the same pattern as nitrates. Values ranged from 782 ppm on a dry ridge near the Putuligayuk River to 11 ppm in an active sand dune. Values above 200 ppm were recorded in most tundra types except aquatic sites, frost scars, estuaries, and sandy riverine and dune sites.

Calcium is abundant everywhere in the Prudhoe Bay landscape. Values range from 623 ppm on a river terrace of the Kuparuk River to over 10,000 ppm on a high-centered polygon near Pad F. The highest mean values are associated with bird mounds, with about 7300 ppm. The lowest values are in sandy estuarine and riverine sites.

Magnesium is abundant because of dolomite in the Sagavanirktok River loess (Parkinson 1978). The highest values are found along the coast. Values range from 1132 ppm in a wet coastal meadow to 50 ppm in the sand dunes. The highest mean values are associated with dry acidic tundra, with an average of 627 ppm, and bird mounds, with 466 ppm. The lowest levels are in sandy riverine sites and dunes. Bilgin (1975) felt that the magnesium levels in the region were relatively low compared to calcite. Parkinson (1978), however, found that dolomite actually exceeded calcite in many Prudhoe Bay soils. High calcite levels were found in the vicinity of the Putuligayuk and Sagavanirktok rivers.

Sodium and chlorine were not measured in this study, but Bilgin (1975) found high levels in the Prudhoe Bay soils, as would be expected from the coastal location. His sodium values ranged from 1.5 to 48.3 ppm. He found less than 1 ppm in an acidic soil at Umiat. Bilgin also looked at sodium and chlorine in surface waters of several lakes in the region and found a high correlation with the distance from the ocean. A lake 5 km from the ocean had 16.8 ppm sodium and 40.6 ppm chlorine, while a lake 35 km from the ocean had only 1.6 ppm sodium and 2.9 ppm chlorine. Work at Barrow indicated that the major source of sodium and chlorine in plants is from the soil and not as spray or mist from the ocean (Ulrich and Gersper 1978).

Relationship of plant taxa to site

Correlations between plant taxa and environmental variables are summarized in Table 9. The environmental variables include chemical and physical characteristics of the soil, distance to the ocean, distance to the Sagavanirktok River, several subjective estimates of site factors (i.e. snow regime, cryoturbation regime, moisture regime and slope) and several animal factors (i.e. presence or sign of caribou, ground squirrels, brown lemmings, collared lemmings, ptarmigan, geese or miscellaneous birds). This section deals with correlations of plant taxa with microscale variables, i.e. soil moisture, moisture regime, available water, slope, hummock size, organic matter, cryoturbation, snow regime and animals. Correlations with mesoscale variables related to the distance from the Sagavanirktok River (pH, soil texture

Table 9. Environmental parameters correlated with plant taxa occurring at least three times in the study. Positive or negative correlations are shown; starred values (*) are correlated at the 0.001 significance level for Pearson's product-moment correlation coefficient; all others are correlated at the 0.05 significance level. The following parameters were selected for this analysis: SAND, SILT, CLAY, ORGMAT, AVH2O, PH, NH4, NO3, CO3, P, K, CA, MG, SLOPE, SNOWREG, CRYOREG, HUMMOCK, CARFECE, SQRRL, BRWNLEM, COLLLEM, PTARMIG, GOOSE, MISBIRD, WDIST, SAGDIS, SMOIS77, MOISREG. (These abbreviations are defined in Table 6.)

Taxa	*Environmental parameters*
Vascular plants	
Alopecurus alpinus	P(+), HUMMOCK(+)
Androsace chamaejasme	ORGMAT(−), PH(+), CO3(+), CA(−), SNOWREG(−), SQRRL(+ *)
Anemone parviflora	CA(−)
Arctagrostis latifolia	HUMMOCK(+)
Arctophila fulva	CLAY(+), SMOIS77(+), NH4(+), HUMMOCK(−)
Artemisia borealis	ORGMAT(−), SMOIS77(−), PH(+), CO3(+), K(−), CA(−), SNOWREG(−), SQRRL(+), SAGDIS(−)
Artemisia glomerata	CA(−), SNOWREG(−), SQRRL(+ *)
Astragalus alpinus	ORGMAT(−), SQRRL(+)
Astragalus umbellatus	K(+), SLOPE(+ *), SNOWREG(+), CRYOREG(+), HUMMOCK(+ *)
Braya purpurascens	K(−), SLOPE(+), SQRRL(+)
Cardamine digitata	SAND(−), SILT(+), CA(+), MG(+), SLOPE(+), HUMMOCK(+ *)
Carex aquatilis	ORGMAT(+), SMOIS77(+ *), PH(−), NH4(+), SLOPE(− *), CRYOREG(− *), HUMMOCK(− *), CARFECE(−)
Carex atrofusca	
Carex bigelowii	CA(+), HUMMOCK(+)
Carex marina	
Carex membranacea	
Carex misandra	ORGMAT(+), PH(−), NO3(+), CO3(−), CRYOREG(+), CARFECE(+ *), AVH2O(+), SAGDIS(+)
Carex rariflora	ORGMAT(+), SMOIS77(+), PH(−), MISBIRD(+), SAGDIS(+)
Carex rotundata	SILT(+)
Carex rupestris	ORGMAT(−), SMOIS77(−), P(+), CRYOREG(+), CARFECE(+)
Carex saxatilis	SAND(−), SILT(+), SMOIS77(+)
Carex scirpoidea	ORGMAT(−), CO3(+), SLOPE(+ *), SNOWREG(+ *), CRYOREG(+), HUMMOCK(+ *), CARFECE(+), MISBIRD(+), COLLLEM(+ *)
Carex subspathacea	GOOSE(+ *), WDIST(−)
Cassiope tetragona	SLOPE(+ *), SNOWREG(+ *), HUMMOCK(+ *), COLLLEM(+)
Carastium beeringianum	HUMMOCK(+)
Chrysanthemum integrifolium	ORGMAT(−), SMOIS77(−), PH(+), CO3(+), P(+ *), K(+ *), SLOPE(+), CRYOREG(+ *), HUMMOCK(+), CARFECE(+ *), COLLLEM(+ *), PTARMIG(+), MISBIRD(+), WDIST(+), SAGDIS(−)
Draba alpina	K(+), CA(+), CRYOREG(+ *), HUMMOCK(+), CARFECE(+ *), PTARMIG(+), WDIST(+)
Draba lactea	SAND(+), SILT(−), ORGMAT(+), PH(− *), NO3(+), CO3(−), WDIST(−), SAGDIS(+)
Dryas integrifolia	ORGMAT(− *), SMOIS77(− *), PH(+), NH4(+ *), P(+ *), SLOPE(+), CRYOREG(+ *), HUMMOCK(+ *), CARFECE(+ *), PTARMIG(+), WDIST(+ *)
Dupontia fisheri	AVH2O(+), MG(+), WDIST(−), BRWNLEM(+)
Epilobium latifolium	SLOPE(+)
Equisetum variegatum	ORGMAT(−), AVH2O(−), MG(−), GOOSE(+ *), NO3(−), CA(−), K(−), SAGDIS(−)
Eriophorum angustifolium	SAND(−), CLAY(+ *), SLOPE(−), SQRRL(−), BRWNLEM(+), K(+)
Eriophorum russeolum	ORGMAT(+), SMOIS77(+), CRYOREG(−)
Eriophorum scheuchzeri	CLAY(+), ORGMAT(+), AVH2O(+ *), SMOIS77(+ *), PH(−), MG(+), HUMMOCK(−), MISBIRD(+ *), SAGDIS(+)
Eriophorum vaginatum	CLAY(+), CARFECE(+), CA(+)
Eutrema edwardsii	SAND(−), SILT(+), CARFECE(+), COLLLEM(+), PTARMIG(+), P(+)
Festuca baffinensis	CA(+), MG(+), SLOPE(+), HUMMOCK(+ *)
Hierochloe pauciflora	SAND(+), SILT(−), ORGMAT(+), SMOIS77(+ *), MG(+ *), K(+), WDIST(−)
Juncus biglumis	NO3(+), CRYOREG(+)
Kobresia myosuroides	CO3(+), P(+)
Lloydia serotina	SLOPE(+ *), SNOWREG(+), HUMMOCK(+ *)
Luzula arctica	CLAY(+), AVH2O(+), PH(−), NO3(+), CO3(−), CRYOREG(+ *), HUMMOCK(+), CARFECE(+ *)
Luzula confusa	MG(+), CA(+), SLOPE(+), HUMMOCK(+), SQRRL(+)
Minuartia arctica	SMOIS77(−), P(+ *), CRYOREG(+ *), CARFECE(+), PTARMIG(+ *), WDIST(+), SAGDIS(−)
Oxytropis nigrescens	SLOPE(+ *), SNOWREG(−), CRYOREG(+)

Table 9 (cont'd).

Taxa	*Environmental parameters*
Papaver lapponicum	CARFECE(+*), PTARMIG(+*)
Papaver macounii	NO3(+), P(+), CA(+), SLOPE(+), HUMMOCK(+*)
Parrya nudicaulis	P(+), SLOPE(+), HUMMOCK(+)
Pedicularis capitata	CA(+), MG(+), SLOPE(+), HUMMOCK(+*), SQRRL(+)
Pedicularis lanata	CRYOREG(+*)
Pedicularis sudetica	SILT(+), SLOPE(*), CRYOREG( ), HUMMOCK( ), CARFECE( ), WDIST(+)
Poa alpigena	SQRRL(+)
Poa arctica	CLAY(+), PH( ), MG(+), CRYOREG(+), CARFECE(+), WDIST( ), SAGDIS(+)
Polemonium boreale	SAND(+), ORGMAT( ), AVH2O( ), P( ), K( ), CA( ), SQRRL(+)
Polygonum viviparum	HUMMOCK(+), SQRRL(+)
Potentilla uniflora	MG(+), SQRRL(+)
Puccinellia andersonii	SNOWREG( ), WDIST( )
Puccinellia phryganodes	CA( ), SNOWREG(+), WDIST( )
Salix arctica	BRWNLEM(+*), WDIST(+)
Salix lanata	
Salix ovalifolia	NO3( ), P( ), HUMMOCK( ), SQRRL(+)
Salix planifolia	SILT( ), CLAY(+), ORGMAT(+), AVH2O(+), PH(*), CO3( ), MG(+), WDIST(*), SAGDIST(+)
Salix reticulata	SAND( ), CA(+), SLOPE(+*), SNOWREG(+), HUMMOCK(+*), COLLLEM(+)
Salix rotundifolia	P(+), SLOPE(+), HUMMOCK(+)
Saussurea angustifolia	CA(+), MG(+), HUMMOCK(+), SAGDIS(+)
Saxifraga cernua	CLAY(+), AVH2O(+), PH( ), MG(+), BRWNLEM(+), WDIST( )
Saxifraga foliolosa	ORGMAT(+), SMOIS77(+), PH( ), MISBIRD(+), SAGDIS(+)
Saxifraga hirculus	SMOIS77(+*), HUMMOCK( )
Saxifraga oppositifolia	ORGMAT( ), SMOIS77( ), PH(+), CO3(+), P(+), CRYOREG(+*), CARFECE(+), PTARMIG(+*), WDIST(+*)
Senecio atropurpureus	SAND(-), SILT(+), SNOWREG(+)
Senecio resedifolius	NO3(+), SLOPE(+), WDIST(+)
Silene acaulis	SLOPE(+), SNOWREG(+), HUMMOCK(+)
Silene wahlbergella	ORGMAT(+), AVH2O(+*), NO3(+), CA(+), MISBIRD(+)
Stellaria humifusa	SAND(+), SILT(−), SAGDIS(+), WDIST(−*)
Stellaria laeta	NO3(+*), CA(+), MG(+*), HUMMOCK(+), SAGDIS(+)
Hepatics	
Anastrophyllum minutum	CLAY(+), HUMMOCK(+), SAGDIS(+)
Blepharostoma trichophyllum	SMOIS77(+), K(+), MG(+), COLLLEM(+), WDIST( )
Plagiochila arctica	P(+), SNOWREG(+), COLLLEM(+*)
Ptilidium ciliare	CLAY(+), AVH2O(+), CA(+), SAGDIS(+)
Radula prolifera	SAND(-), CLAY(+), CARFECE(+)
Scapania simmonsii	SAND(-), CLAY(+), PH(−), SAGDIS(+)
Mosses	
Aulacomnium acuminatum	
Aulacomnium palustre	SILT(-), SLOPE(+), SNOWREG(+), HUMMOCK(+)
Aulacomnium turgidum	CARFECE(+*), PTARMIG(+*)
Bryum stenotrichum	CRYOREG(+), CARFECE(+), PTARMIG(+), SAGDIS(+)
Calliergon richardsonii	
Campylium stellatum	BRWNLEM(+*)
Catoscopium nigritum	SILT(+), GOOSE(+*), SAGDIS( ), CA(+)
Cinclidium arcticum	SILT(+)
Cinclidium latifolium	GOOSE(+*)
Cirriphyllum cirrosum	CARFECE(+), WDIST(+)
Dicranum angustum	CLAY(+*), ORGMAT(+), AVH2O(+), PH(-*), CO3(-), P(−), MG(+), SAGDIS(+*)
Dicranum elongatum	CLAY(+*), AVH2O(+), PH(-), MG(+), WDIST( ), SAGDIS(+)
Didymodon asperifolius	P(+), SLOPE(+)
Distichium capillaceum	COLLLEM(+*)
Distichium inclinatum	CLAY(+), AVH2O(+), CO3( ), P(−), CARFECE(+), WDIST(+)
Ditrichum flexicaule	SAND( ), SILT(+), ORGMAT( ), SMOIS77( ), PH(+), CO3(+), P(+*), K(+), MG(-), SNOWREG(+), CRYOREG(+), HUMMOCK(+), CARFECE(+), COLLLEM(+), WDIST(+*), SAGDIS( )
Drepanocladus brevifolius	SMOIS77(+), SLOPE( ), CRYOREG( ), CARFECE( )
Drepanocladus uncinatus	ORGMAT( ), SMOIS77( ), P(+), SNOWREG(+), CRYOREG(+), COLLLEM(+)
Encalypta alpina	P(+*), K(+), CA(+), CRYOREG(+), CARFECE(+), COLLLEM(+), PTARMIG(+*), WDIST(+)

Table 9 (cont'd). Environmental parameters correlated with plant taxa occurring at least three times in the study.

Taxa	*Environmental parameters*
Encalypta procera	SAND(−), SILT(+), K(+), SNOWREG(+), HUMMOCK(+), BRWNLEM(+ *), COLLLEM(+ *)
Hylocomium splendens	CLAY(+), AVH2O(+), SAGDIS(+)
Hypnum bambergeri	SILT(+), WDIST(+)
Hypnum procerrimum	NH4(+), HUMMOCK(+), COLLLEM(+)
Leptobryum pyriforme	SLOPE(+), HUMMOCK(+), PTARMIG(+ *)
Meesia triquetra	
Meesia uliginosa	SAND(−), SILT(+), K(+), CA(+)
Mnium blyttii	CLAY(+), ORGMAT(+), PH(−), CO3(−), MG(+ *)
Oncophorus wahlenbergii	CLAY(+), PH(−), CO3(−), CRYOREG(+), SAGDIS(+)
Orthothecium chryseum	SAND(−), SILT(+), MISBIRD(+), WDIST(+)
Philonotis fontana	CLAY(+)
Polytrichastrum alpinum	CLAY(+ *), AVH2O(+ *), PH(− *), CARFECE(+), WDIST(−), SAGDIS(+)
Rhacomitrium lanuginosum	CLAY(+), AVH2O(+), NO3(+ *), HUMMOCK(+)
Rhytidium rugosum	AVH2O(+), PH(+ *), CA(+), HUMMOCK(+), PTARMIG(+ *)
Scorpidium scorpioides	SAND(−), SILT(+), SMOIS(+), CRYOREG(−)
Scorpidium turgescens	WDIST(+)
Tetraplodon mnioides	CRYOREG(+), CARFECE(+ *), PTARMIG(+)
Thuidium abietinum	P(+), PH(+)
Timmia austriaca	P(+), SLOPE(+ *), HUMMOCK(+)
Tomenthypnum nitens	SAND(−), SILT(+), P(+), SNOWREG(+), COLLLEM(+)
Tortella arctica	CLAY(+), NH4(+)
Tortula ruralis	P(+ *), SNOWREG(+), HUMMOCK(+)
Lichens	
Alectoria nigricans	AVH2O(+ *), NO3(+ *), CO3(−), CRYOREG(+ *), PH(−), HUMMOCK(+), CARFECE(+ *), SAGDIS(+)
Cetraria cucullata	AVH2O(+), NO3(+), CO3(−), CA(+), SLOPE(+ *), CRYOREG(+), HUMMOCK(+ *), SAGDIS(+ *)
Cetraria delisei	SLOPE(+), SNOWREG(+ *), COLLLEM(+ *)
Cetraria islandica	CO3(−), CA(+), CRYOREG(+ *), HUMMOCK(+ *), CARFECE(+ *), PTARMIG(+)
Cetraria nivalis	NO3(+ *), CO3(−), CA(+), SLOPE(+ *), CRYOREG(+), HUMMOCK(+), SAGDIS(+)
Cetraria richardsonii	SLOPE(+ *), SNOWREG(+), HUMMOCK(+)
Cladonia gracilis	CLAY(+ *), ORGMAT(+ *), AVH2O(+ *), PH(− *), CO3(− *), P(−), MG(+), CRYOREG(+), HUMMOCK(+), CARFECE(+), SAGDIS(+ *)
Cladonia phyllophora	SAND(+), SILT(−), ORGMAT(+), AVH2O(+), PH(− *), CO3(−), WDIST(+ *), SAGDIS(+)
Cladonia pocillum	AVH2O(+), NO3(+ *), SAGDIS(+)
Cornicularia divergens	NO3(+ *), AVH20(+), SAGDIS(+)
Dactylina arctica	SAND(−), CLAY(+ *), AVH2O(+)
Dactylina ramulosa	PH(−)
Evernia perfragilis	SAND(+), SILT(−)
Hypogymnia subobscura	SAND(+), SILT(−), NO3(+ *), MG(+), K(+), SNOWREG(−), CRYOREG(+ *), CARFECE(+ *), SQRRL(+ *)
Lecanora epibryon	P(+), ORGMAT(−), SMOIS77(−), K(+), SNOWREG(−), CRYOREG(+ *), CARFECE(+), PTARMIG(+), HUMMOCK(+)
Lecidea vernalis	NO3(+), CO3(−), CRYOREG(− *), CARFECE(+ *), PTARMIG(+), SAGDIS(+)
Ochrolechia frigida	ORGMAT(+), AVH2O(+ *), NO3(+), CA(+), CRYOREG(+), CARFECE(+ *), SAGDIS(+)
Peltigera aphthosa	SLOPE(+), HUMMOCK(+), CA(+), SAGDIS(+)
Peltigera canina	SLOPE(+ *), HUMMOCK(+ *)
Pertusaria coriacea	SLOPE(− *), SNOWREG(−), CRYOREG(+)
Physconia muscigena	SLOPE(+), CRYOREG(+), HUMMOCK(+), CARFECE(+)
Stereocaulon alpinum	CLAY(+)
Thamnolia subuliformis	SMOIS77(−), NH4(−), CA(+), CRYOREG(+ *), HUMMOCK(+), CARFECE(+ *), WDIST(+)
Alga	
Nostoc commune	ORGMAT(+), SMOIS77(+ *), NH4(+)

and soil nutrients) are discussed in the next chapter.

Two things should be considered when examining Table 9 and the correlation tables that follow. First, these correlations apply only to the range of variables at Prudhoe Bay. For example, many plants that are normally thought of as calciphiles or basiphiles may not correlate with calcium, carbonates or pH because of the range of these parameters within the Prudhoe Bay landscape. Second, several of the variables are strongly linked to each other (Table 10). These interactions are very complex, and no statistical treatment has been used to unravel them. The information from Table 10 was used to aid in the interpretations discussed below.

Species correlations with moisture-related factors. High correlations would be expected between most taxa used as keys for the vegetation stand types along the principal moisture gradient and the estimates of site moisture. Table 11 reflects this very well. Of the 13 taxa that appear in the stand type names along the alkaline moisture gradient (Table 3, Stand Types B1, B2, U3, U4, M2, M4, E1 and E2), 10 are in the list in Table 11, and 7 of these are correlated at the 0.001 level. Of the 36 taxa that show strong negative correlations with site moisture regime, 72% are found in Stand Types B1 or B2. The remaining 28% are associated with dune and dry river bar stand types.

Fourteen of the taxa (39%) are lichens (7 crustose and 7 fruticose), 12 (33%) are forbs, 2 (6%) are prostrate shrubs, 3 (8%) are graminoids and 3 (8%) are mosses.

Sixteen taxa show strong positive correlations with moisture regime; 7 of these (44%) are graminoid, and 4 (25%) are mosses. These are all associated with wet, and particularly with aquatic, tundra types. Taxa that show strong correlations with soil moisture but that occur in the more mesic sites would not be expected to have significant linear regressions since they probably have more bell-shaped distribution patterns.

The nonsubjective variables related to site moisture regime give a better picture of the nature of the gradient. For instance, fewer taxa correlate with the actual percentage of soil moisture (Table 12) than those with the subjective moisture rating, particularly for negative correlations. Note that only two lichens show significant correlations with soil moisture.

The list of taxa correlated to hummock size (Table 13), however, is longer than that for the moisture regime rating, with 47 taxa showing positive correlations. This list contains only 33% of the plants in Table 11. It contains many that are associated primarily with xero-mesic sites, which are typically more hummocky than the dry sites. Several of the taxa in this list are found on bird mounds or in association with small moss hummocks.

Forty-five taxa are positively correlated with slope (Table 14). Many of the plants in this list are also positively correlated with snow regime, as would be expected.

The picture that develops is that soil moisture is indeed an important factor, particularly for many of the dominant plants in the landscape, such as *Carex aquatilis, Dryas integrifolia, Drepanocladus brevifolius* and *Scorpidium scorpioides*. The percentage of soil moisture, however, varies considerably depending on the organic content of the soil and does not correlate well with many of the taxa used for identifying stand types. Often sites that appear quite dry are actually dry only on the surface. It is here, in a relatively thin surface layer, that many of the lichens and mosses find optimum conditions for growth. The moisture conditions 10 cm deep are often very different and unrelated to the shallow-rooted plants on the surface. This is particularly true in the dry organic soils.

Many taxa at Prudhoe Bay appear to rely heavily on hummocks, where they find the moisture conditions best suited for their growth. This is to be expected in such a wet environment. In fact, more species are correlated to hummock height than to any other variable used in this analysis. Hummocks were not examined in detail in this study, but this result should encourage more in-depth work, such as Raup's (1965) studies of turf hummocks in Greenland.

Another factor related to site moisture is available water (Table 15). The list of taxa highly correlated with this factor is surprisingly very different than the list of plants correlated with soil moisture (Table 12). The lists have only one plant in common, *Eriophorum scheuchzeri*. This is also the only species that is correlated with both site moisture regime (Table 11) and available water (Table 15). Available water is defined as that part of the soil moisture that is readily absorbable by the plants. It is the difference between the wilting point (measured at 15 bars suction) and the field capacity (measured at ⅓ bars suction), which is the amount of water remaining in the soil after it is saturated and then freely drained. Since most of the Prudhoe Bay soils are completely saturated, there is not a high degree of correspondence between the available water and the total soil moisture.

Table 10. Pearson's correlation coefficient matrix for all environmental variables. Double starred (**) coefficients are correlated at P ≤ 0.001; single starred (*) coefficients are correlated at 0.001 < P ≤ 0.05. Values of 99.00 denote uncalculable coefficients.

	SAND	SILT	CLAY	HYGMOIS	ORGMAT	H2OABSN	FLDCAP	WILTPT	AVH2O	BDENS77	SMOIS77	PH	NH4
SAND	1.000												
SILT	-0.881**	1.000											
CLAY	-0.634**	0.194	1.000										
HYGMOIS	-0.092	-0.093	0.344*	1.000									
ORGMAT	0.098	-0.247*	0.200	0.933**	1.000								
H2OABSN	-0.133	0.065	0.161	0.781**	0.841**	1.000							
FLDCAP	-0.094	-0.049	0.261*	0.936**	0.953**	0.909**	1.000						
WILTPT	-0.051	-0.039	0.162	0.874**	0.933**	0.944**	0.965**	1.000					
AVH2O	-0.184	-0.055	0.447**	0.668**	0.545**	0.355**	0.615**	0.388**	1.000				
BDENS77	0.224*	-0.102	-0.299*	-0.708**	-0.721**	-0.733**	-0.743**	-0.728**	-0.428**	1.000			
SMOIS77	-0.103	0.044	0.141	0.664**	0.707**	0.848**	0.764**	0.786**	0.328**	-0.781**	1.000		
PH	-0.129	0.371*	-0.340*	-0.779**	-0.863**	-0.598**	-0.760**	-0.710**	-0.540**	0.561**	-0.515**	1.000	
NH4	-0.112	-0.146	0.393*	0.263*	0.359**	0.321*	0.306*	0.338**	0.078	-0.387**	0.370**	-0.352**	1.000
NO3	-0.240	0.232	0.081	0.508**	0.394**	0.299*	0.453**	0.379**	0.449**	-0.326*	0.208*	-0.289*	-0.070
CO3	-0.159	0.369*	-0.274*	-0.684**	-0.678**	-0.447**	-0.588**	-0.571**	-0.355**	0.433**	-0.379**	0.703**	-0.207*
P	-0.243*	0.324*	-0.043	-0.192*	-0.207*	-0.114	-0.169	-0.117	-0.233*	0.083	-0.249*	0.375**	-0.144
K	-0.175	0.055	0.218	0.254*	0.261*	0.300*	0.278*	0.322*	0.042	-0.296*	0.189*	-0.172	-0.103
CA	-0.425*	0.355*	0.219	0.678**	0.538**	0.490**	0.625**	0.552**	0.549**	-0.488**	0.291*	-0.258*	-0.146
MG	0.098	-0.438**	0.447**	0.747**	0.687**	0.538**	0.671**	0.606**	0.554**	-0.439**	0.429**	-0.618**	0.239*
MOISREG	-0.224*	0.092	0.315*	0.371**	0.456**	0.569**	0.491**	0.502**	0.218*	-0.623**	0.657**	-0.351**	0.421**
TEMPREG	-0.370*	0.527**	-0.093	-0.220*	-0.297*	-0.026	-0.155	-0.093	-0.266*	0.159	-0.091	0.428**	-0.112
SNOWREG	-0.265*	0.241*	0.156	0.065	0.045	0.065	0.063	0.051	0.067	-0.187*	0.110	-0.011	0.008
CRYOREG	0.059	-0.081	0.011	-0.051	-0.094	-0.282*	-0.134	-0.192*	0.102	0.259*	-0.312**	0.010	-0.248*
HUMMOCK	-0.095	0.122	-0.003	0.097	-0.017	-0.185*	-0.040	-0.097	0.152	0.034	-0.293*	-0.032	-0.227*
SLOPE	-0.003	0.070	-0.108	-0.164	-0.248*	-0.276*	-0.281*	-0.265*	-0.194*	0.319**	-0.313**	0.255*	-0.187*
ASPECT	-0.050	0.131	-0.109	-0.199*	-0.264*	-0.269*	-0.276*	-0.270*	-0.156	0.310*	-0.293*	0.273*	-0.186*
THAW77	0.226*	-0.061	-0.368*	-0.602**	-0.581**	-0.494**	-0.605**	-0.535**	-0.524**	0.624**	-0.444**	0.556**	-0.221*
H2ODPTH	-0.158	0.035	0.271*	0.071	0.113	0.423**	0.239*	0.281*	-0.006	-0.232*	0.356**	-0.025	0.499**
SDIST	-0.396**	0.479**	0.039	0.127	-0.002	0.137	0.098	0.119	-0.014	-0.067	0.102	0.092	-0.077
WDIST	-0.387**	0.567**	-0.123	-0.318**	-0.440**	-0.252*	-0.351**	-0.334**	-0.233*	0.148	-0.148	0.519**	-0.300*
SAGDIS	0.237*	-0.506**	0.335*	0.733**	0.735**	0.401**	0.632**	0.536**	0.613**	-0.478**	0.415**	-0.811**	0.209*
SOILCOV	0.337*	-0.308*	-0.195	-0.166	-0.063	-0.011	-0.034	0.021	-0.185*	0.227*	-0.029	0.086	0.003
ROCKCOV	0.174	-0.140	-0.132	-0.181*	-0.182*	-0.191*	-0.216*	-0.195*	-0.175	0.329**	-0.147	0.128	-0.146
H2OCOV	-0.184	0.123	0.181	0.074	0.124	0.375**	0.228*	0.234*	0.097	-0.340**	0.514**	-0.012	0.445**
MARL	-0.266*	0.324*	0.021	0.010	0.047	0.164	0.093	0.148	-0.119	-0.355**	0.381**	0.081	0.439**
BEAR	99.000	99.000	99.000	0.185*	0.102	0.022	0.083	0.070	0.082	-0.076	-0.006	-0.066	-0.012
FOX	-0.027	0.103	-0.124	-0.156	-0.175	-0.139	-0.137	-0.122	-0.117	0.130	-0.166	0.154	-0.142
CARFECE	0.171	-0.167	-0.085	-0.036	-0.061	-0.195*	-0.076	-0.099	0.036	0.179	-0.262*	-0.050	-0.091
CARGRAZ	-0.231	0.261*	0.050	-0.005	-0.022	0.061	0.000	0.043	-0.137	-0.119	0.021	0.102	-0.010
SQRRL	0.384*	-0.321*	-0.290*	-0.268*	-0.256*	-0.208*	-0.239*	-0.193*	-0.266*	0.352**	-0.249*	0.262*	-0.094
BRWNLEM	-0.182	0.153	0.137	0.042	0.057	0.098	0.089	0.096	0.020	-0.056	-0.012	-0.044	-0.054
COLLEM	-0.138	0.197	-0.043	-0.097	-0.129	-0.124	-0.119	-0.115	-0.071	0.120	-0.149	0.140	-0.111
PTARMIG	0.026	-0.020	-0.023	-0.061	-0.088	-0.095	-0.085	-0.108	0.032	0.137	-0.090	0.052	-0.085
GOOSE	0.367*	-0.336*	-0.224	-0.165	-0.048	-0.073	-0.139	-0.104	-0.182	-0.046	-0.045	0.003	0.164
MISBIRD	-0.174	0.205	0.025	0.288*	0.209*	0.185	0.198*	0.136	0.299*	-0.094	0.249*	-0.164	-0.074
BRYOCOV	-0.450**	0.480**	0.149	0.102	0.004	0.078	0.054	0.054	0.029	-0.238*	0.075	0.085	0.081
FLICCOV	-0.086	0.062	0.078	0.169	0.000	-0.143	0.037	-0.075	0.357**	0.061	-0.169	-0.013	-0.092
CLICCOV	0.151	-0.218*	0.043	-0.027	-0.038	-0.189*	-0.093	-0.113	0.010	0.151	-0.206*	-0.134	-0.162
ERECDED	0.041	-0.139	0.143	0.182*	0.292*	0.280*	0.279*	0.287*	0.121	-0.240*	0.173*	-0.227*	0.185
PROSDED	-0.121	0.051	0.167	0.161	0.104	0.092	0.145	0.070	0.303*	-0.156	0.100	-0.096	-0.044

	THAW77	H2ODPTH	SDIST	WDIST	SAGDIS	SOILCOV	ROCKCOV	H2OCOV	MARL	BEAR	FOX	CARFECE	CARGRAZ
THAW77	[illegible]												
H2ODPTH	-0.100	1.000											
SDIST	[illegible]	0.116	1.000										
WDIST	0.189*	0.019	0.557**	1.000									
SAGDIS	-0.461**	-0.103	-0.075	-0.564**	1.000								
SOILCOV	0.453**	0.136	-0.173*	-0.190*	-0.074	1.000							
ROCKCOV	0.384*	-0.037	0.081	0.111	-0.114	0.427**	1.000						
H2OCOV	[illegible]	0.807**	0.136	0.095	-0.099	0.084	-0.058	1.000					
MARL	[illegible]	0.317**	0.121	0.193*	-0.179*	0.036	-0.070	0.591**	1.000				
BEAR	[illegible]	-0.028	0.084	-0.016	0.149	-0.075	-0.019	-0.037	-0.045	1.000			
FOX	0.344**	-0.067	0.168	0.086	-0.053	-0.080	-0.023	-0.096	-0.117	-0.033	1.000		
CARFECE	0.122	-0.143	0.197*	-0.052	0.137	-0.164	-0.008	-0.191*	-0.231*	-0.065	0.215*	1.000	
CARGRAZ	-0.075	-0.075	0.201*	0.278*	-0.184*	-0.154	-0.057	-0.104	0.204*	-0.038	-0.099	-0.127	1.000
SQRRL	0.359**	-0.078	-0.099	-0.028	-0.179	0.353**	-0.042	-0.109	-0.133	0.194*	0.130	0.013	-0.113
BRWNLEM	[illegible]	-0.040	0.108	-0.067	-0.040	-0.108	-0.027	-0.052	-0.014	-0.018	-0.047	-0.027	0.162
COLLEM	0.286*	-0.065	0.256*	0.005	-0.104	-0.153	-0.039	-0.088	-0.058	-0.030	0.379**	0.243*	-0.052
PTARMIG	0.023	0.054	0.115	0.111	0.078	-0.120	-0.003	-0.067	-0.102	-0.028	0.234*	0.310*	-0.087
GOOSE	[illegible]	-0.067	-0.282*	-0.234*	0.035	0.117	-0.045	-0.081	-0.062	-0.030	-0.029	-0.078	-0.091
MISBIRD	[illegible]	0.088	0.265	0.044	0.224*	-0.199*	-0.013	0.039	-0.172	0.042	0.141	0.164	-0.091
BRYOCOV	[illegible]	-0.050	0.134	0.305**	-0.175*	-0.516**	-0.168*	-0.097	0.130	-0.102	-0.026	-0.066	0.244*
FLICCOV	[illegible]	[illegible]	0.197*	0.120	0.147	-0.244*	-0.073	-0.165	-0.199*	-0.034	-0.010	0.466**	-0.138
CLICCOV	[illegible]	[illegible]	-0.081	-0.053	0.127	-0.107	0.003	-0.135	-0.164	-0.046	0.099	0.457**	-0.136
ERECDED	[illegible]	[illegible]	-0.236*	-0.308**	0.149	-0.254*	-0.213*	-0.092	-0.091	-0.050	-0.116	-0.276*	0.020
PROSDED	[illegible]	[illegible]	-0.036	0.013	0.155	-0.328**	-0.191*	0.062	-0.089	-0.082	0.038	-0.025	0.022

NO3	CO3	P	K	CA	MG	MOISREG	TEMPREG	SNOWREG	CRYOREG	HUMMOCK	SLOPE	ASPECT
1 000												
-0 361**	1 000											
0 014	0 223*	1 000										
0.171	-0.183	0 460**	1 000									
0.606**	-0.355**	0 328*	0 467**	1 000								
0 529**	-0 582**	-0 256*	0 276*	0 464**	1 000							
-0.051	-0.113	-0 215*	-0.026	0 072	0 113	1 000						
-0.104	0.175*	0.347**	0.032	0 037	-0 440**	-0 164	1 000					
-0 029	0 008	0 057	0 115	0 122	-0 076	0 228*	0 102	1 000				
0 335*	-0 046	0 173	0 187*	0 140	0 111	-0 482**	0 002	-0 108	1 000			
0.230*	-0 012	0.199*	0 152	0 334**	0 113	-0 420**	0 024	0 146	0 464**	1 000		
0.073	0 095	0 207*	-0 032	0 080	-0 080	-0 439**	0 122	0 151	0 170*	0 500**	1 000	
-0.046	0.144	0 136	-0 060	-0 020	-0 170	-0 425**	0 169*	0 373**	0 093	0 383**	0 801**	1 000
-0 270*	0 297*	-0 007	-0 300*	-0 465**	-0 384**	-0 487**	0 332**	-0 156	0 032	-0 009	0 474**	0 418**
-0.135	-0 005	-0 059	-0 155	-0 146	-0 147	0 382**	0 131	0 028	-0 166	-0 216*	-0 107	-0 099
0 194*	-0 223*	0 157	0 010	0 288*	-0 159	-0 099	0 824**	0 162	0 056	0 126	0 163	0 181*
-0.081	0 383**	0 396**	-0 029	0 030	-0 610**	-0 119	0 744**	0 085	0 033	0 039	0 051	0 024
0.465**	-0 709**	-0 346**	0 120	0 394**	0 687**	0 195*	-0 520**	0 003	0 090	0 082	-0 073	-0 099
-0 025	0 037	-0 302*	-0 301*	-0 322*	-0 090	-0 119	-0 082	-0 226*	-0 152	-0 261*	0 074	0 098
-0.079	-0 099	-0.056	-0 150	-0 205*	-0 136	-0 249*	0 076	-0 023	-0 064	-0 146	0 103	0 058
-0.079	0 076	-0.057	-0 111	-0 068	-0 056	0 500**	0 150	0 034	-0 223*	-0 296*	-0 146	-0 136
0 040	0 132	0 093	0 023	-0 012	-0.137	0 487**	0 177*	0 035	-0 269*	-0 267*	-0 176*	-0 164
0 131	-0 111	-0 071	0.007	0 246*	0 313*	0 017	-0 018	-0 106	-0 082	0 288*	0 187*	-0 048
0.002	0 140	0 345*	0.327*	0 080	-0 076	-0 263*	0 189*	0 047	0 161	0 194*	0 136	0 231*
0.012	-0 193*	0.225*	0.207*	0 120	-0 025	-0 477**	0 116	-0 092	0 591**	0 360**	0 157	0 134
-0 013	-0 011	0 236*	0.235*	0.161	-0.141	0 147	0 331**	0 187*	-0 133	-0 148	-0 108	-0 065
-0.162	0 266*	-0.058	0 016	-0 214*	-0.035	-0 301*	0 071	-0 392**	-0 039	-0 108	0 144	0.106
-0 032	-0 080	-0.152	0.277*	0 119	0 078	0 064	0 103	0 006	0 005	0 004	-0 076	-0 069
-0 052	0.120	0.259*	0 149	0 085	-0 084	-0 284*	0 237*	0 430**	0 121	0 424**	0 380**	0 630**
0 012	-0.047	0.338*	0.107	0 011	-0 012	-0 227*	0 090	-0 197*	0 222*	0 028	-0 060	-0 101
-0.126	0.028	-0.052	-0.186	-0 241*	-0 138	0 137	-0 245*	-0 056	-0 158	-0 090	-0 128	-0 116
0.157	-0.173	-0.027	0.065	0 244*	0 157	-0 008	0 060	0 018	0 103	0 095	0 122	0 075
-0 072	0.075	0.266*	0 178	0 223*	-0.124	0 169*	0 192*	0 256*	-0 182*	0 090	-0 124	0 016
0 237*	-0.103	-0.015	0 045	0 321*	0.102	-0.317**	0 063	0 003	0 519**	0 421**	0 045	0 025
0 145	-0.045	0.119	0.115	-0.031	0.100	-0 340**	-0 109	-0 282*	0 654**	0 286*	0 073	-0 053
-0 153	-0.123	-0.203*	0.007	-0 078	0 235*	0.298*	-0 221*	0 066	-0 257*	-0 147	-0 244*	-0 239*
0 150	-0.101	-0.013	0 191*	0 245*	0.190*	0 105	-0 082	0 067	0 113	0 018	-0 201*	-0 171*

SQRRL	BRWNLEM	COLLEM	PTARMIG	GOOSE	MISBIRD	BRYOCOV	FLICCOV	CLICCOV	ERECDED	PROSDED
1 000										
-0 053	1 000									
-0 090	-0 043	1 000								
-0 061	-0 040	0 004	1 000							
0 050	-0 043	-0 073	0 002	1 000						
-0 075	0 014	0 177	0 146	-0 074	1 000					
-0 285*	0 111	0 137	-0 107	-0 039	-0 095	1 000				
-0 091	-0 084	-0 018	0 154	-0 141	0 043	0 066	1 000			
-0 008	-0 066	-0 030	0 257*	-0 112	-0 005	-0 262*	0 306**	1 000		
-0 119	0 145	-0 160	-0 125	0 201*	-0 170	0 128	-0 146	-0 292*	1 000	
-0 222*	0 094	-0 016	0 113	-0 198*	-0 004	0 098	0 133	-0 071	0 256*	1 000

Table 11. Plants correlated with site moisture regime (MOISREG). Starred (*) entries are correlated at the 0.001 level; all others are correlated at the 0.05 level.

Positive correlations	*Negative correlations*
Vascular plants	**Vascular plants**
*Arctophila fulva**	*Androsace chamaejasme*
Caltha palustris	*Armeria maritima*
*Carex aquatilis**	*Artemisia arctica*
Carex saxatilis	*Artemisia borealis*
Carex subspathacea	*Artemisia glomerata*
Eriophorum russeolum	*Astragalus umbellatus*
*Eriophorum scheuchzeri**	*Carex rupestris*
*Pedicularis sudetica**	*Carex scirpoidea*
Puccinellia phryganodes	*Chrysanthemum integrifolium**
Ranunculus pallasii	*Draba alpina**
Utricularia vulgaris	*Dryas integrifolia**
	Elymus arenarius
Bryophytes	*Kobresia myosuroides*
Cinclidium latifolium	*Minuartia arctica*
*Drepanocladus brevifolius**	*Oxytropis nigrescens*
Meesia triquetra	*Papaver lapponicum*
*Scorpidium scorpioides**	*Salix ovalifolia*
	Saxifraga oppositifolia
Alga	
Nostoc commune	**Bryophytes**
	Ditrichum flexicaule
	Drepanocladus uncinatus
	Encalypta alpina
	Lichens
	Caloplaca sp.
	Cetraria cucullata
	Cetraria islandica
	Cetraria nivalis
	Evernia perfragilis
	Hypogymnia subobscura
	*Lecanora epibryon**

Table 12. Plants correlated with soil moisture in late August 1977 (SMOIS77). Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	*Negative correlations*
Vascular plants	**Vascular plants**
Arctophila fulva	*Artemisia borealis*
*Caltha palustris**	*Carex rupestris*
*Carex aquatilis**	*Chrysanthemum integrifolium*
Carex rariflora	*Dryas integrifolia**
Carex saxatilis	*Minuartia arctica*
Eriophorum russeolum	*Saxifraga oppositifolia*
*Eriophorum scheuchzeri**	
*Hierochloe pauciflora**	**Bryophytes**
*Ranunculus pallasii**	*Ditrichum flexicaule*
Saxifraga foliolosa	*Drepanocladus uncinatus*
*Saxifraga hirculus**	
*Utricularia vulgaris**	**Lichens**
	Lecanora epibryon
Bryophytes	*Thamnolia subuliformis*
Blepharostoma trichophyllum	
Drepanocladus brevifolius	
Scorpidium scorpioides	
Alga	
*Nostoc commune**	

Table 13. Plants correlated with height of hummocks (HUMMOCK). Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	*Negative correlations*
Vascular plants	**Vascular plants**
Alopecurus alpinus	*Arctophila fulva*
Arctagrostis latifolia	*Carex aquatilis**
*Astragalus umbellatus**	*Eriophorum scheuchzeri*
*Cardamine digitata**	*Pedicularis sudetica*
Carex bigelowii	*Salix ovalifolia*
*Carex scirpoidea**	*Saxifraga hirculus*
*Cassiope tetragona**	
Cerastium beeringianum	
Chrysanthemum integrifolium	
Draba alpina	
*Dryas integrifolia**	
*Festuca baffinensis**	
Festuca rubra	
*Lloydia serotina**	
Luzula arctica	
Luzula confusa	
*Papaver macounii**	
Parrya nudicaulis	
*Pedicularis capitata**	
Poa glauca	
Polygonum viviparum	
*Salix reticulata**	
Salix rotundifolia	
Saussurea angustifolia	
Silene acaulis	
Stellaria laeta	
Bryophytes	
Anastrophyllum minutum	
Lophozia sp.	
Aulacomnium palustre	
Ditrichum flexicaule	
Encalypta procera	
Funaria arctica	
Hypnum procerrimum	
Leptobryum pyriforme	
Rhacomitrium lanuginosum	
Rhytidium rugosum	
Timmia austriaca	
Tortula ruralis	
Lichens	
Alectoria nigricans	
Caloplaca sp.	
*Cetraria cucullata**	
*Cetraria islandica**	
Cetraria nivalus	
Cetraria richardsonii	
Cladonia gracilis	
Cladonia pocillum	
Dactylina arctica	
Dactylina ramulosa	
Lecanora epibryon	
Ochrolechia frigida	
Peltigera aphthosa	
*Peltigera canina**	
Pertusaria sp.	
Physconia muscigena	
Thamnolia subuliformis	

Table 14. Plants correlated with slope angle (SLOPE). **Starred (*) entries are correlated at 0.001 level; others are correlated at the 0.05 level.**

Positive correlations	*Negative correlations*
Vascular plants	**Vascular plants**
Anemone richardsonii	*Carex aquatilis**
*Astragalus umbellatus**	*Eriophorum angustifolium*
Braya purpurascens	*Pedicularis sudetica*
Cardamine digitata	
*Carex scirpoidea**	**Bryophytes**
*Cassiope tetragona**	*Campylium stellatum*
Chrysanthemum integrifolium	*Drepanocladus brevifolius*
Dryas integrifolia	
Epilobium latifolium	
Festuca baffinensis	
Festuca rubra	
*Lloydia serotina**	
Luzula confusa	
Oxytropis borealis	
*Oxytropis nigrescens**	
Papaver macounii	
Parrya nudicaulis	
Pedicularis capitata	
Poa glauca	
Salix reticulata	
Salix rotundifolia	
Senecio resedifolius	
Silene acaulis	
Bryophytes	
Aulacomnium palustre	
Didymodon asperifolius	
Funaria arctica	
Hypnum cupressiforme	
Hypnum revolutum	
Leptobryum pyriforme	
*Timmia austriaca**	
Tortula ruralis	
Lichens	
*Cetraria cucullata**	
Cetraria delisei	
*Cetraria nivalis**	
*Cetraris richardsonii**	
Cetraria tilesii	
Peltigera aphthosa	
*Peltigera canina**	
Pertusaria sp.	
Physconia muscigena	
*Xanthoria elegans**	

The plants that correlate with available water are primarily found in moderately well drained organic soils. The two notable exceptions are *Dupontia fisheri* and *Eriophorum scheuchzeri*, which have their modal distributions in wet, highly organic sites. The cryptogams in the moderately well drained sites appear to be influenced by available water percentages to a greater extent than the vascular plants are; 61% of the plants correlated with available moisture are bryophytes or lichens. The list of taxa correlated with available water is reflected to some extent in the correlations with or-

Table 15. Plants correlated with the percentage of available water (AVH2O). **Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.**

Positive correlations	*Negative correlations*
Vascular plants	**Vascular plants**
Caltha palustris	*Equisetum variegatum*
Carex misandra	*Polemonium boreale*
Dupontia fisheri	
*Eriophorum scheuchzeri**	
Luzula arctica	
Pyrola grandiflora	
Ranunculus pallasii	
Salix planifolia	
Saxifraga cernua	
*Silene wahlbergella**	
Utricularia vulgaris	
Bryophytes	
Lophozia sp.	
Ptilidium ciliare	
Dicranum angustum	
Dicranum elongatum	
Distichium inclinatum	
Hylocomium splendens	
*Polytrichastrum alpinum**	
Polytrichaceae	
Rhacomitrium lanuginosum	
Rhytidium rugosum	
Tomenthypnum nitens	
Lichens	
*Alectoria nigricans**	
Cetraria cucullata	
*Cladonia gracilis**	
Cladonia phyllophora	
Cladonia pocillum	
Cornicularia divergens	
*Dactylina arctica**	
*Ochrolechia frigida**	
Pertusaria dactylina	

ganic matter (Table 16). About 40% of the taxa correlated with available water are also correlated with organic matter. These taxa are again mainly from the more mesic areas. Taxa that are correlated with both organic matter and soil moisture are generally closer to the extremes of the moisture gradient.

The correlations with organic matter and available water are also closely linked to the pH gradient and other influences due to loess. These are discussed more thoroughly in Chapter 4.

Species correlations with soil nutrients. Correlations between plant taxa and nutrients are difficult to establish on a microscale because of the large standard errors in total nutrient statistics and the large quantity of data required for analysis. Several investigators (including Gersper et al. 1980 and Everett 1980a) have shown that nutrients, particularly phosphorus, can fluctuate widely within homogeneous map units.

Table 16. Plants correlated with the percentage of organic matter (ORGMAT). Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	Negative correlations
Vascular plants	**Vascular plants**
Caltha palustris	*Androsace chamaejasme*
Carex aquatilis	*Armeria maritima*
Carex misandra	*Artemisia borealis*
Carex rariflora	*Astragalus alpinus*
Draba lactea	*Carex rupestris*
Eriophorum russeolum	*Carex scirpoidea*
Eriophorum scheuchzeri	*Chrysanthemum integrifolium*
Hierochloe pauciflora	*Dryas integrifolia**
Petasites frigidus	*Equisetum variegatum*
Ranunculus pallasii	*Kobresia myosuroides*
Salix planifolia	*Polemonium boreale*
Saxifraga foliolosa	*Saxifraga oppositifolia*
Silene wahlbergella	
Utricularia vulgaris	**Bryophytes**
	Ditrichum flexicaule
Bryophytes	*Drepanocladus uncinatus*
Dicranum angustum	
Mnium blyttii	**Lichens**
Mnium rugicum	*Lecanora epibryon*
Polytrichaceae	
Lichens	
Alectoria ochroleuca	
*Cladonia gracilis**	
Cladonia lepidota	
Cladonia phyllophora	
Cladonia squamosa	
Ochrolechia frigida	
Alga	
Nostoc commune	

Until recently most information regarding arctic plant nutrient relationships has been inferred from site observations; few ecological investigations have involved detailed soil analyses. Work begun during the IBP Tundra Biome program approached nutrient relationships more directly. That work focused on phosphorus and nitrogen, particularly with *Dupontia fisheri, Carex aquatilis, Eriophorum angustifolium* and a few other graminoids (Chapin 1972, 1973, 1978, 1980, Chapin et al. 1975, McKendrick et al. 1978, 1980). Recent studies with tundra-plant nutrient limitations (Ulrich and Gersper 1978) and the response of tundra to fertilization (Chapin 1978, McKendrick et al. 1978, 1980) have greatly increased our knowledge.

The arctic tundra is seen in this and other work (e.g. Warren Wilson 1957, Haag 1974) as a nutrient-poor environment, particularly with respect to available phosphorus and nitrogen. The only sites where Ulrich and Gersper (1978) consistently found plants not deficient in nitrates were owl mounds. These sites were usually rich in healthy grasses and dicots, while most of the wet tundra has stunted growth of sedges and mosses. *Carex aquatilis, Dupontia fisheri, Eriophorum angustifolium* and presumably most low-temperature, low-phosphorus plants are adapted to tolerate extremely low levels of phosphorus through very efficient phosphate absorption mechanisms (Chapin and Bloom 1976, Chapin et al. 1975, 1980a, b, Chapin 1977, 1978, 1980).

Webber (1978) used 33 common tundra taxa to correlate vegetation types with soluble phosphate levels at Barrow. Several taxa showed distinct correlations with phosphate. *Dupontia fisheri, Arctagrostis latifolia, Alectoria nigricans* and *Dactylina arctica* showed positive correlations; *Eriophorum russeolum, Drepanocladus brevifolius* and *Calliergon sarmentosum* showed negative correlations. Webber found four general trends: 1) bryophytes were concentrated in low-phosphorus areas, 2) caespitose monocots, rosette dicots, lichens and evergreen shrubs were in sites with moderate phosphorus, 3) deciduous shrubs were in areas with slightly higher phosphate levels, and 4) mat, cushion and erect dicots were in high phosphate areas. Single-shoot monocotyledons were independent of phosphorus. This information was based on a data set with only 15 phosphate determinations.

At Prudhoe Bay the growth forms exhibit slightly different correlations with phosphorus (Table 17). Evergreen shrubs (i.e. *Dryas integrifolia* and *Cassiope tetragona*) and pleurocarpous mosses show highly significant positive corelations with phosphorus. Others showing significant positive correlations include prostrate deciduous shrubs and mat and cushion dicotyledons. Only deciduous willows between 3 and 10 cm tall are negatively correlated with phosphorus. Table 17 lists strong correlations between several soil parameters and growth forms. Soil moisture, phosphorus and calcium are correlated with the greatest number of growth forms. Nitrates, ammonium, pH and organic matter also show strong correlations with several growth forms. Soil texture, carbonates, potassium and magnesium are less important in the correlations.

Correlations between soil nutrients and individual plant taxa (Tables 18–21) give more detailed information. Most of these nutrients show highly significant correlations with the loess gradient (i.e. SAGDIS, Table 10), which, as we will see in the next chapter, influences nearly all the soil properties. Because of the strong interaction between variables and because of the scarcity of information in the literature to support or reject the

Table 17. Correlations between growth form and soil variables. Positive and negative correlations for Pearson's product moment correlation coefficient are shown; the starred entries (*) are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	Negative correlations
Soil moisture	
Single-shoot monocotyledons*	Evergreen shrubs* < 10 cm
Algae*	Mat dicotyledons
	Rosette dicotyledons
	Crustose lichens
	Fruticose lichens
Organic matter	
Single-shoot monocotyledons	Evergreen shrubs* < 10 cm
Aquatic dicotyledons	Cushion dicotyledons
Algae	
Silt	
Pleurocarpous mosses	
Acrocarpous mosses	
Algae	
pH	
Evergreen shrubs < 10 cm	Single-shoot monocotyledons
Cushion dicotyledons*	Leafy liverworts
NO_3	
Deciduous shrubs < 3 cm	Deciduous shrubs 3-10 cm
Caespitose monocotyledons	Horsetails
Fruticose lichens	
K	
Acrocarpous mosses	Rosette dicotyledons
Mg	
Single-shoot monocotyledons	
Aquatic dicotyledons	
Available water	
Aquatic dicotyledons	
Leafy liverworts	
Sand	
Mat dicotyledons	Pleurocarpous mosses
	Acrocarpous mosses
Clay	
Deciduous shrubs < 3 cm	
Aquatic dicotyledons	
NH_4	
Single monocotyledons	Evergreen shrubs < 10 cm
Algae	Cushion lichens
P	
Evergreen shrubs* < 10 cm	Deciduous shrubs 3-10 cm
Deciduous shrubs < 3 cm	
Cushion dicotyledons	
Mat dicotyledons	
Pleurocarpous mosses	
Ca	
Deciduous shrubs < 3 cm	Deciduous shrubs 3-10 cm
Caespitose monocotyledons	Horsetails
Leafy liverworts	
Foliose lichens	
Fruticose lichens	

Table 18. Plants correlated with total available ammonium (NH4). Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	Negative correlations
Vascular plants	**Vascular plant**
Arctophila fulva	*Dryas integrifolia*
Carex aquatilis	
	Bryophyte
Bryophytes	*Hypnum procerrimum*
Scorpidium scorpioides	
Tortella arctica	**Lichen**
	Thamnolia subuliformis

Table 19. Plants correlated with total available nitrate (NO3). Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	Negative correlations
Vascular plants	**Vascular plants**
Carex misandra	*Equisetum variegatum*
Draba lactea	*Salix ovalifolia*
Juncus biglumis	
Luzula arctica	
Papaver macounii	
Silene acaulus	
Silene wahlbergella	
*Stellaria laeta**	
Bryophytes	
Polytrichaceae	
*Rhacomitrium lanuginosum**	
Lichens	
*Alectoria nigricans**	
Cetraria cucullata	
*Cetraria nivalis**	
*Cladonia pocillum**	
*Cornicularia divergens**	
*Hypogymnia subobscura**	
Lecidea ramulosa	
Lecidea vernalis	
Ochrolechia frigida	

Table 20. Plants correlated with total available phosphorus (P). Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	*Negative correlations*
Vascular plants	**Vascular plants**
Alopecurus alpinus	*Armeria maritima*
Carex rupestris	*Eriophorum scheuchzeri*
Cerastium berringianum	*Pedicularis sudetica*
*Chrysanthemum integrifolium**	*Polemonium boreale*
*Dryas integrifolia**	*Salix ovalifolia*
Eutrema edwardsii	
Festuca rubra	**Bryophytes**
*Minuartia arctica**	*Dicranum angustum*
*Papaver macounii**	*Distichum inclinatum*
Parrya nudicaulis	Polytrichaceae
Salix rotundifolia	
Saxifraga oppositifolia	**Lichen**
	Cladonia gracilis
Bryophytes	
Plagiochila arctica	
Dicranum sp.*	
Didymodon asperifolius	
*Ditrichum flexicaule**	
Drepanocladus uncinatus	
*Encalypta alpina**	
Hypnum revolutum	
*Rhytidium rugosum**	
*Thuidium abietinum**	
Timmia austriaca	
Tomenthypnum nitens	
*Tortula ruralis**	
Lichens	
Cetraria tilesii	
Lecanora epibryon	
*Peltigera spuria**	

information in Tables 18–21, they should be regarded as hypotheses on which to base further experiments and observations. Some of the correlations are, however, supported by literature from other areas in the Arctic. For example, the positive correlations between ammonium and *Arctophila fulva* and *Carex aquatilis* are logical in view of the work of Gersper et al. (1980). The positive correlations between nitrates and phosphorus and several dicot and dry graminoid taxa are equally logical in view of the work of Webber (1978), McKendrick et al. (1980), Gersper et al. (1980) and others. The strong correlation between *Dryas* and phosphorus was specifically noted by Tedrow (1970).

Species correlations with snow depth regime. The list of taxa correlated with snow depth (Table 22) is fairly long and contains most of the diagnostic taxa in Stand Types B14, U6 and U7. It does not contain *Salix rotundifolia*, which nearly always occurs as an important plant in deep snow beds. This is probably due to a bimodal distribution pattern, since *S. rotundifolia* also occurs as a

Table 21. Plants correlated with total available potassium (K). Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	*Negative correlations*
Vascular plants	**Vascular plants**
Astragalus umbellatus	*Armeria maritima*
*Chrysanthemum integrifolium**	*Artemisia borealis*
Draba alpina	*Equisetum variegatum*
Eriophorum angustifolium	*Polemonium boreale*
Hierochloe pauciflora	
Bryophytes	
Blepharostoma trichophyllum	
Calypogeia muelleriana	
Cratoneuron arcticum	
Dicranum sp.	
Ditrichum flexicaule	
Encalpyta alpina	
Encalypta procera	
Meesia uliginosa	
Lichens	
Hypogymnia subobscura	
Lecanora epibryon	
Peltigera spuria	

Table 22. Plants correlated with snow depth regime (SNOWREG). Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	*Negative correlations*
Vascular plants	**Vascular plants**
Anemone richardsonii	*Androsace chamaejasme*
Astragalus umbellatus	*Artemisia borealis*
*Carex scirpoidea**	*Artemisia glomerata*
*Cassiope tetragona**	*Cochlearia officinalis*
Equisetum scirpoides	*Lesquerella arctica*
Gentianella propinqua	*Oxytropis nigrescens*
Lloydia serotina	*Puccinellia andersonii*
Oxytropis borealis	
Puccinellia phryganodes	**Lichens**
Salix reticulata	*Evernia perfragilis*
Senecio atropurpureus	*Fulgensia bracteata*
Silene acaulis	*Hypogymnia subobscura*
	Lecanora epibryon
Bryophytes	*Toninia cumulata*
Plagiochila arctica	*Xanthoria elegans*
Aulacomnium palustre	
Ditrichum flexicaule	
Drepanocladus uncinatus	
Encalypta procera	
Hypnum cupressiforme	
Timmia norvegica	
Tomenthypnum nitens	
Lichens	
*Cetraria delisei**	
Cetraria richardsonii	

dominant plant in many exposed sites. Other plants that are associated with snow beds include *Cassiope tetragona, Carex scirpoidea, Senecio atropurpureus, Silene acaulis, Salix reticulata, Gentianella propinqua, Lloydia serotina, Equisetum scirpoides, Ditrichum flexicaule, Tomenthypnum nitens, Depanocladus uncinatus* and *Cetraria richardsonii.* The appearance of *Puccinellia phryganodes* in the list is surprising and is probably due to the selection of some sites in estuaries that are also snow collection areas. This correlation is barely significant at the 0.05 level. The list of plants with negative correlations to snow depth includes *Oxytropis nigrescens, Lesquerella arctica* and several crustose lichens, all members of Stand Type B1.

Growth forms that show a positive correlation with snow depth are evergreen shrubs (10–30 cm tall), single-shoot graminoid monocotyledons, nongraminoid monocotyledons and pleurocarpous and acrocarpous mosses. Crustose lichens show a negative correlation with snow depth. Fruticose lichens are most common in early-melting snowbanks but are rare in late-melting snowbanks.

Species correlations with cryoturbation regime. The list of taxa positively correlated with cryoturbation (Table 23) is long and reflects both the importance of frost stirring in the Prudhoe Bay landscape and the adaptations required of plants to survive in a frost-active environment. Plants with compressed growth forms, such as caespitose monocotyledons and cushion dicotyledons, apparently have an advantage over plants with rhizomatous root systems, such as most single monocotyledons (Table 24). Lichens have an advantage because of reduced competition from other plants and because they do not have roots in the unstable soil. Pleurocarpous mosses, in contrast, are relatively scarce, possibly because of the usually xeric environment. However, several small acrocarpous mosses, such as *Bryum wrightii, B. stenotrichum, Encalypta alpina* and *Ditrichum flexicaule*, are positively correlated with frost disturbance. Taxa with negative correlations to cryoturbation are species typically found in very wet meadows.

Frost disturbance was not examined in detail at Prudhoe Bay. All types of frost disturbance, including frost scars, solifluction and turf hummocks, were considered in one broad category. The length of the list of taxa (Table 23) and the high significance of many of these correlations suggest that this gradient deserves more attention, as suggested by Hopkins and Sigafoos (1951) and Sigafoos (1952).

Table 23. Plants correlated with cryoturbation regime (CRYOREG). **Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.**

Positive correlations	*Negative correlations*
Vascular plants	**Vascular plants**
Astragalus umbellatus	*Carex aquatilis**
Carex misandra	*Eriophorum russeolum*
*Carex rupestris**	*Pedicularis sudetica*
Carex scirpoidea	
*Dryas integrifolia**	**Bryophytes**
Juncus biglumis	*Drepanocladus brevifolius*
*Luzula arctica**	*Scorpidium scorpioides*
*Minuartia arctica**	
Oxytropis nigrescens	
*Pedicularis lanata**	
Poa arctica	
*Saxifraga oppositifolia**	
Bryophytes	
Bryum stenotrichum	
Bryum wrightii	
Ditrichum flexicaule	
Drepanocladus uncinatus	
Encalypta alpina	
*Hypnum procerrimum**	
Oncophorus wahlenbergii	
Tetraplodon mnioides	
Lichens	
*Alectoria nigricans**	
Cetraria cucullata	
*Cetraria islandica**	
Cetraria nivalis	
Cladonia gracilis	
*Cladonia pocillum**	
Cornicularia divergens	
Dactylina ramulosa	
Evernia perfragilis	
*Hypogymnia subobscura**	
*Lecanora epibryon**	
*Lecidea vernalis**	
Ochrolechia frigida	
Pertusaria sp.	
Physconia muscigena	
Solorina sp.*	
*Thamnolia subuliformis**	

Table 24. Growth forms correlated with cryoturbation regime. **Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.**

Positive correlations	*Negative correlations*
Caespitose monocotyledons	Single-shoot monocotyledons*
Cushion dicotyledons*	Pleurocarpous mosses
Crustose lichens*	
Fruticose lichens*	
Foliose lichens	

Table 25. Plants correlated with sign of brown lemmings (BRWNLEM). Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	*Negative correlations*
Vascular plants	
*Dupontia fisheri**	
*Eriophorum angustifolium**	
Salix arctica	
Bryophytes	
*Calypogeia muelleriana**	
Encalypta procera	
Fissidens sp.	
Meesia uliginosa	

Table 26. Plants correlated with sign of collared lemmings (COLLLEM). Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	*Negative correlations*
Vascular plants	
Anemone richardsonii	
*Carex scirpoidea**	
Cassiope tetragona	
*Chrysanthemum integrifolium**	
*Equisetum arvense**	
*Equisetum scirpoides**	
Eutrema edwardsii	
Gentianella propinqua	
Oxytropis borealis	
Salix reticulata	
Bryophytes	
Blepharostoma trichophyllum	
Lophozia sp.	
Plagiochila arctica	
*Distichium capillaceum**	
Ditrichum flexicaule	
Drepanocladus uncinatus	
Encalypta alpina	
*Encalypta procera**	
Hypnum procerrimum	
Leptobryum pyriforme	
*Timmia norvegica**	
Tomenthypnum nitens	
Lichen	
Cetraria delisei	

Species correlations with animal-related factors. It is evident that considerable information regarding animal use of habitat can be gleaned from comprehensive vegetation sampling. Tables 25–30 list plant correlations with several animal-related factors and reflect some rather distinct patterns. Brown lemmings (Table 25) tend to concentrate in areas with high percentages of *Eriophorum angustifolium* and *Dupontia fisheri*. This was also noted by Batzli and Jung (1980) at Atkasook, Alaska. The correlation with *Salix arctica* is curious, considering Batzli and Jung's data suggesting an avoidance of willows. Collared lemming sign (Table 26) is concentrated in snow accumulation areas, particularly in the *Cassiope* band. Ptarmigan (Table 27) have a distinct correlation with vegetation associated with bird mounds and dry sites, probably due to the early spring activities when the males occupy elevated sites for their mating rituals. Considerable goose sign (Table 28) is asso-

Table 27. Plants correlated with sign of ptarmigan (PTARMIG). Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	*Negative correlations*
Vascular plants	
*Artemisia arctica**	
Chrysanthemum integrifolium	
Draba alpina	
Dryas integrifolia	
Eutrema edwardsii	
Lesquerella arctica	
*Minuartia arctica**	
*Papaver lapponicum**	
*Saxifraga oppositifolia**	
Bryophytes	
*Aulacomnium turgidum**	
Bryum stenotrichum	
Dicranum sp.*	
*Leptobryum pyriforme**	
Pohlia sp.*	
Polytrichastrum alpinum	
Tetraplodon mnioides	
Lichens	
Alectoria nigricans	
Cetraria islandica	
Cornicularia divergens	
Lecanora epibryon	
Lecidea vernalis	
Peltigera spuria	

Table 28. Plants correlated with goose feces (GOOSE). Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	*Negative correlations*
Vascular plants	
*Carex subspathacea**	
*Equisetum variegatum**	
Bryophytes	
*Catascopium nigritum**	
Cinclidium arcticum	

Table 29. Plants correlated with arctic ground squirrels (SQRRL). Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	*Negative correlations*
Vascular plants	**Vascular plant**
*Androsace chamaejasme**	*Eriophorum angustifolium*
Androsace septentrionalis	
Armeria maritima	
Artemisia borealis	
Artemisia glomerata	
Bromus pumpellianus	
*Elymus arenarius**	
Luzula confusa	
Pedicularis capitata	
Poa alpigena	
Poa glauca	
Polemonium boreale	
Polygonum viviparum	
Potentilla uniflora	
Ranunculus pedatifidus	
Salix ovalifolia	
Saxifraga hieracifolia	
Taraxacum ceratophorum	
Bryophytes	
Bryum arcticum	
Ceratodon purpureus	
Funaria arctica	
Lichen	
*Hypogymnia subobscura**	

Table 30. Plants correlated with caribou feces (CARFECE). Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	*Negative correlations*
Vascular plants	**Vascular plants**
*Artemisia arctica**	*Carex aquatilis*
*Carex misandra**	*Pedicularis sudetica*
*Carex rupestris**	
*Chrysanthemum integrifolium**	**Bryophyte**
Draba alpina	*Drepanocladus brevifolius*
*Dryas integrifolia**	
Eriophorum vaginatum	
Eutrema edwardsii	
Luzula arctica	
Minuartia arctica	
*Papaver lapponicum**	
Poa arctica	
Saxifraga oppositifolia	
Bryophytes	
Radula prolifera	
*Aulacomnium turgidum**	
Bryum stenotrichum	
Cirriphylum cirrosum	
Distichium inclinatum	
Ditrichum flexicaule	
Encalpyta alpina	
Leptobryum pyriforme	
Pohlia sp.	
Polytrichastrum alpinum	
*Tetraplodon mnioides**	
Lichens	
*Alectoria nigricans**	
Alectoria ochroleuca	
Caloplaca sp.*	
*Cetraria islandica**	
Cetraria tilesii	
Cladonia gracilis	
Cornicularia divergens	
*Hypogymnia subobscura**	
Lecanora epibryon	
Lecidea ramulosa	
*Lecidea vernalis**	
Ochrolechia frigida	
Pertusaria sp.	
Physconia muscigena	
Thamnolia subuliformis	

ciated with *Carex subspathacea* and reflects the heavy use of the wet saline meadows by migrating flocks of black brant during early spring (Bergman et al. 1977). The plants associated with squirrels and ptarmigan (Tables 27 and 29) are mainly dicotyledons and grasses that respond to the increased supply of nutrients from these animals.

The correlations between caribou feces and dry tundra species (Table 30) should be evaluated cautiously. Although White and Trudell (1980) documented heavy use of dry, exposed sites by caribou in winter, the abundance of caribou feces in dry sites at Prudhoe Bay is probably at least partly a function of slower decay rates in dry areas. The negative correlation between caribou feces and three main taxa of wet *Carex aquatilis, Drepanocladus brevifolius* graminoid meadows may be due to more rapid decomposition of feces in wet areas, although White (White et al. 1975, White and Trudell 1980) noted that caribou avoid wet areas, possibly due both to the lower food value of *Carex aquatilis* compared to shrubs and *Eriophorum* and to high insect levels in these areas. A proper assessment of use by caribou and other animals should be based on a multiple factor index such as that used by White and Trudell (1980, Table 1).

SUMMARY

This chapter treats several microscale aspects of the Prudhoe Bay vegetation. Vegetation communities are described along the following gradients: 1) site moisture, 2) snow, 3) cryoturbation, 4) animal activity, 5) coastal disturbances, 6) sand dunes and 7) fluvial disturbance. Maps from the Prudhoe Bay geobotanical atlas (Walker et al. 1980) are analyzed. The results show that 45% of the 140-km² area is water-covered. About 43% is wet tundra, 19% is moist tundra, and less than 1% is

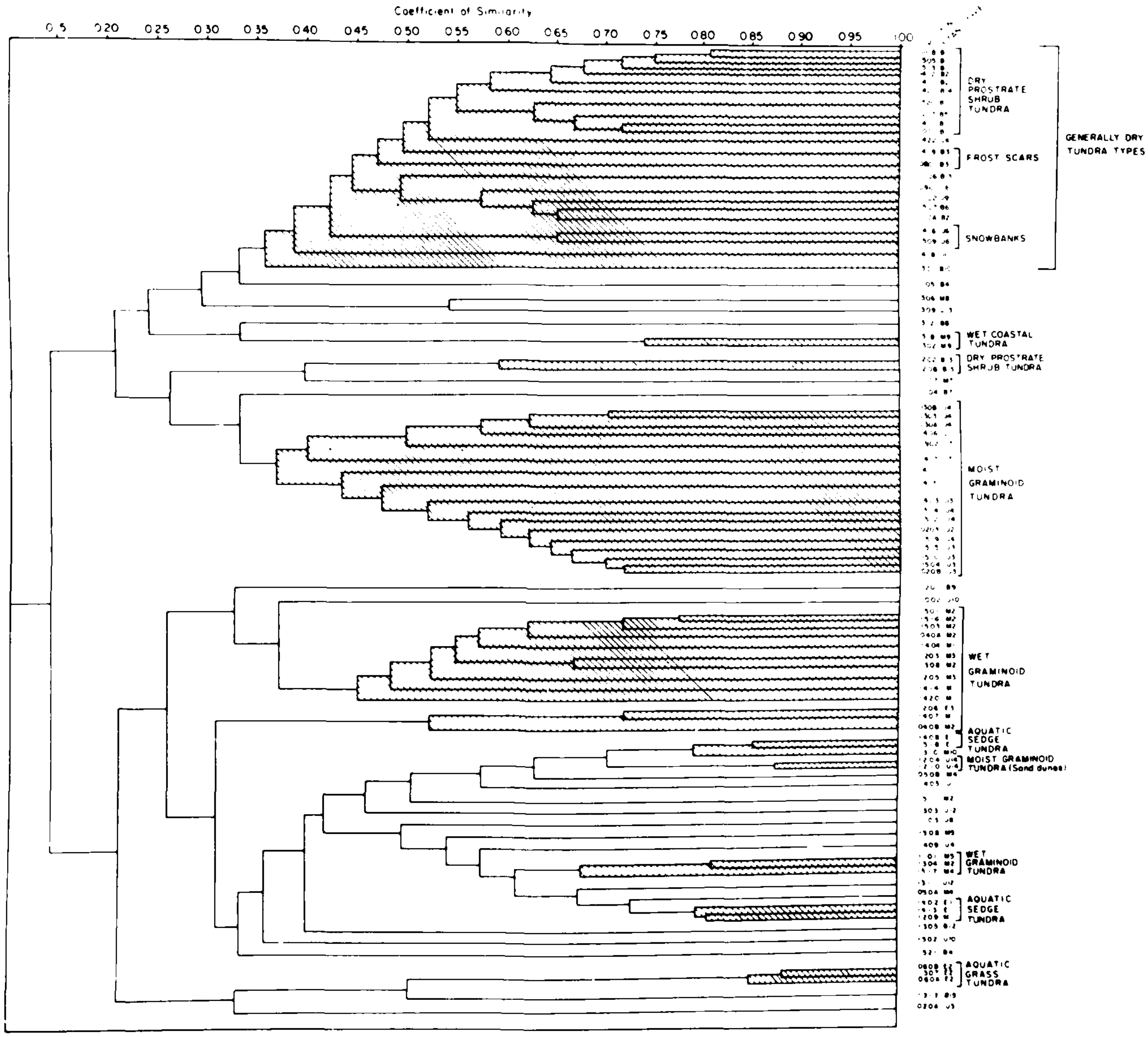


Figure 43. Dendrogram of 92 vegetation study plots. Clustering is performed on the basis of Sorenson's coefficient of similarity: $C = 2w/(a + b)$, *where* a *is the sum of the cover values of the plants in one stand,* b *is the similar sum for the second stand, and* w *is the sum of the cover values for species that occur in both stands. The Y axis represents the level of similarity between plots or clusters of plots. The shaded areas represent clusters that are relevant to the moisture gradient.*

Table 31. Number of taxa correlated with microscale variables.

Variable	*Positive correlations*	*Negative correlations*	*Total*
Moisture gradient			
MOISREG	16	28	44
SMOIS77	17	9	26
HUMMOCK	55	6	61
SLOPE	41	5	46
AVH2O	31	2	33
ORGMAT	25	15	40
Soil nutrients			
NH4	4	3	7
NO3	19	2	21
P	27	9	36
K	16	4	20
Snow gradient			
SNOWREG	23	13	36
Cryoturbation gradient			
CRYOREG	37	5	42
Animals			
BRWNLEM	7	0	7
COLLLEM	23	0	23
PTARMIG	22	0	22
GEESE	4	0	4
SQRRL	22	1	23
CARFECE	39	3	42

dry tundra. Disturbed tundra, including roads and pads, covered 15% of the mapped areas in 1973. There are more lakes, strangmoor and pingos in the western portion of the oilfield and more low-centered polygons in the eastern portion.

Data from 92 study plots are used to examine relations among microenvironmental variables and species cover along the moisture, snow, cryoturbation and animal activity gradients. Correlation analysis shows that soil moisture correlates with nearly all the measured soil parameters.

The number of taxa correlated with the various environmental variables (Table 31) gives a good impression of the relative importance of the variables within the region. Factors related to the moisture gradient exert primary control over the vegetation, especially on the taxa that are dominant in the landscape. The moisture gradients, in turn, are strongly related to small changes in elevation associated with patterned ground. Hummock size is a particularly important variable. Although it received relatively little attention in this study, it correlates with 61 plant taxa.

A dendrogram of the 92 study plots (Fig. 43) reemphasizes the importance of the moisture gradient within the Prudhoe Bay landscape. The major clusters clearly reflect the categories of dry, moist, wet and aquatic tundras. Nieland and Hok (1975) did the first vegetation analysis in the Prudhoe Bay region. Their one-dimensional species ordination also reflected the importance of the moisture gradient.

Among the soil nutrients, phosphorus is correlated to the most species (36). Thirty-six taxa are correlated with snow depth and 42 with cryoturbation.

The correlations with animal sign are potentially useful but need to be interpreted cautiously. In some cases, particularly for ptarmigan, brown lemmings and ground squirrels, the correlations are likely due to fertilization and/or food preference. In other cases, however, the relationship of an animal with a particular plant is a function of similar habitat requirements for both species and does not necessarily reflect interaction between the plant and the animal. In the case of caribou the correlation partially reflects a site characteristic that preserves the animal sign.

These results tend to support the recent investigations in the Arctic that favor a community approach to studying the vegetation. The ruderal nature of arctic vegetation described by Griggs (1934) does not appear to be a major obstacle to such an approach. Cantlon (1961) suggested that the apparent ruderal character of arctic species may be due in part to the confusion caused by many small, closely spaced communities. This is particularly true in the patterned ground complexes of the Prudhoe Bay region.

CHAPTER 4. MESOSCALE GRADIENTS

Cantlon (1961) considered two main types of mesoscale relationships. The first includes drainage, snow and other gradients associated with such features as hills, river drainages, alluvial fans and moraines. At Prudhoe Bay mesoscale relief gradients are found in association with streams and pingos. The changes in soil characteristics due to mesoscale relief are due mostly to the moisture gradient, which was discussed in the preceding chapter. The second type of mesoscale relationship is related to changes in parent material caused by glacial, glacio-fluvial, eolian and marine events. These changes affect a wide variety of site factors, such as the amount of carbonates, the drainage characteristics of the soil, and frost-induced phenomena.

This chapter deals almost exclusively with parent-material changes related to loess deposited from the Sagavanirktok River. The prevailing winds from the east-northeast transport the vast majority of the loess. The deposits are concentrated in areas south of a line drawn west-southwest from the delta of the Sagavanirktok River (Fig. 44). There is a large area near the coast west of Prudhoe Bay that is relatively unaffected by loess. The loess decreases downwind from the Sagavanirktok River, and a suite of soil parameters, including percentage of organic matter, pH, soil particle size, soil nutrients and water-holding capacity, are consequently affected, sometimes in complex ways. Parkinson (1978) first documented soil changes related to the loess gradient. He showed an inverse linear relationship between $CaCO_3$ equivalence and the percentage of organic carbon.

The objectives here are to describe the major influences of loess on the plant environment and to correlate the plant taxa with the various substrate gradients.

METHODS

The substrate effects of loess were studied in two ways. The first was to examine 15 plots in roughly equivalent wet tundra microsites along the loess gradient and outside the loess region (Table 32). Nine of the plots lay downwind from the Sagavanirktok River, and six were north of the area of loess deposition. All of the plots were in wet tundra areas (Stand Types M1, M2 and M4), including low-centered polygons, strangmoor and wet lake margins. The soils all had deep organic layers and were generally hemic, except in the Type M4 plots, which had fibric organic materials. Regression analysis was used to examine the values of several soil parameters as a function of distance from the Sagavanirktok River measured in the direction of the prevailing wind.

The second portion of the substrate analysis was to examine the data from all 93 study plots and to produce scattergrams for the soil variables as functions of soil pH. This was done to portray variations in the environment between the major study sites (Fig. 34). The method of analysis was the same as that used for the microscale variables discussed in Chapter 3. Pearson's product moment correlation coefficients were calculated between each species and each environmental variable related to the loess gradient. The major variables discussed here are particle size, carbonates, pH, calcium, magnesium and distance from the Sagavanirktok River.

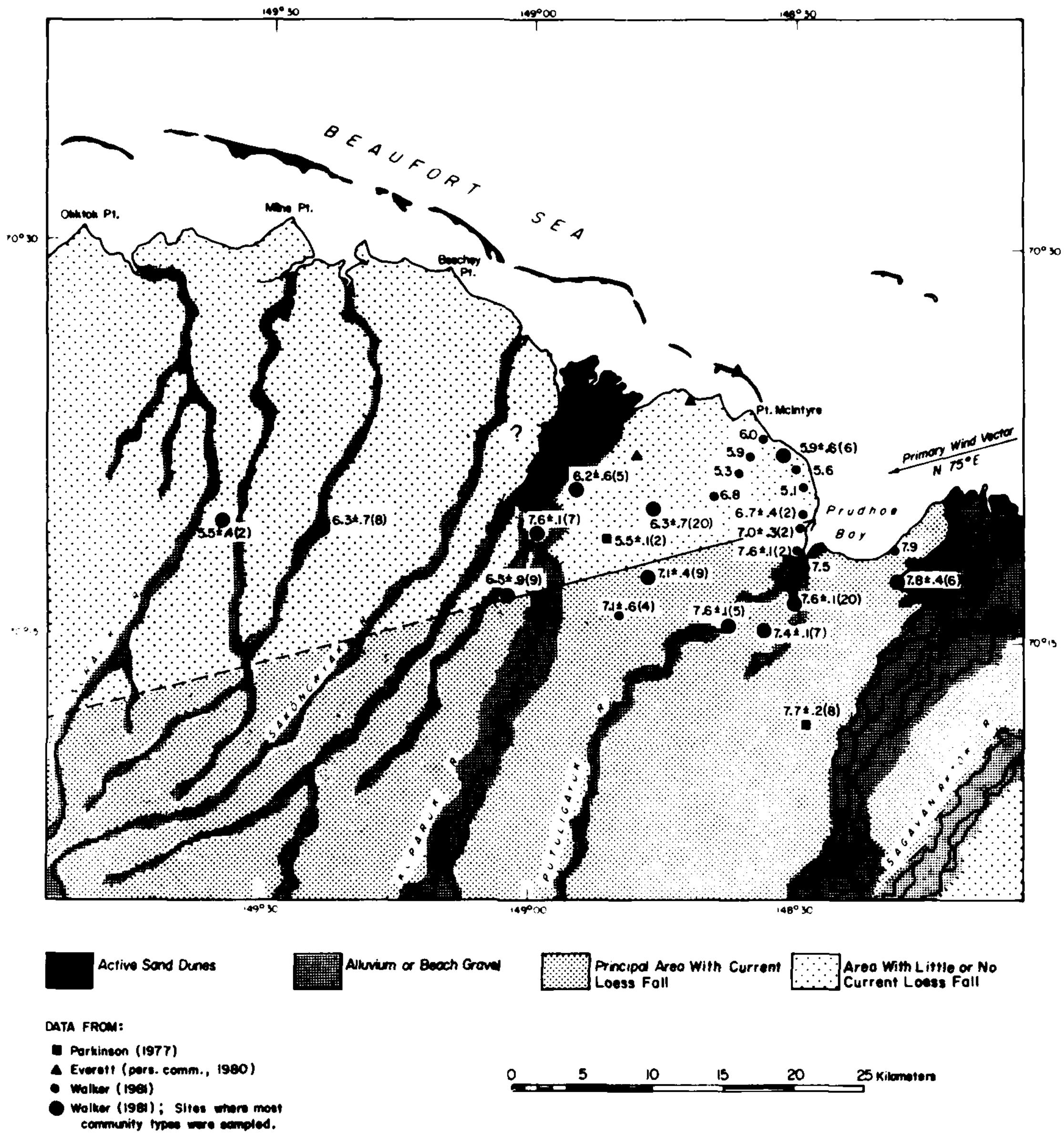


Figure 44. Areas of current loess fall west of the Sagavanirktok River. Soil pH values are shown: mean pH ± 1 S.E. (number of samples). Loess deposits are concentrated south of a line drawn S75°W from the delta of the Sagavanirktok River. Areas south of this line and east of the Kuparuk are alkaline. West of the Kuparuk River wet areas tend to be acidic but pH values are still considerably higher than north of the loess line. Wet areas north of the line are consistently acidic throughout the region with the possible exception of areas near the dunes in the delta of the Kuparuk River. Sites with alkaline soils north of this loess line include pingos, frost boils, dune and beach sand, and river alluvium.

Table 32. Soil parameters for 15 wet tundra plots. SAGDIS refers to the distance of the study plot from the Sagavanirktok River measured along the N 75°E wind vector.

	Plot/Location														
	Wet alkaline tundra									*Wet acidic tundra*					
	040A IBP	*040B Put R.*	*050A IBP*	*050B Put R.*	*1203 Dunes*	*1501 D.S. 2*	*1503 D.S. 2*	*1511 D.S. 2*	*1516 D.S. 2*	*1304 Coast*	*1308 Coast*	*1404 Pad F*	*1407 Pad F*	*1413 Pad F*	*1414 Pad F*
SAGDIS (km)	13.2	20.2	13.2	20.2	0.3	9.3	9.3	9.3	9.3	—	—	—	—	—	—
SAND (%)	8.3	6.4	6.2	6.2	32.8	22.9	—	17.6	30.5	48.7	91.0	14.0	—	—	—
SILT (%)	72.7	70.9	75.8	70.8	53.7	62.8	—	64.8	55.0	18.2	4.2	63.9	—	—	—
CLAY (%)	19.0	22.7	18.0	23.0	13.5	14.3	—	17.6	14.5	33.1	4.8	22.1	—	—	—
ORGMAT (%)	31.9	41.1	32.3	42.7	18.1	27.3	38.6	17.7	14.9	70.3	65.8	59.2	61.1	60.7	42.7
BDEN (g cm⁻³)	0.24	0.33	0.16	0.15	0.89	0.38	0.31	0.51	0.44	0.31	0.12	0.22	0.22	0.14	0.22
SMOIS (%)	274	198	402	417	51	171	207	122	136	166	577	295	271	469	344
FLDCAP (%)	83.3	88.9	76.9	103.3	53.2	56.4	77.5	46.8	30.9	106.8	137.5	103.4	109.2	124.5	99.8
WILTPT (%)	64.3	84.2	74.4	95.8	37.6	44.1	62.0	30.7	24.9	92.8	118.5	78.8	93.1	111.1	79.5
AVH2O	19.0	4.7	2.5	7.5	15.6	12.3	15.5	16.1	6.0	14.0	19.0	24.6	16.1	13.4	20.3
HYGMOIS (%)	5.1	6.3	3.7	5.6	1.9	4.3	6.5	3.3	2.5	8.4	10.4	8.5	7.9	8.3	5.8
H2OABSN (%)	247.4	289.2	269.1	323.9	172.4	189.7	202.8	105.3	105.7	280.0	404.2	310.1	295.4	247.3	201.3
CO3 (%)	21.7	3.3	20.8	6.0	24.0	17.4	15.1	20.7	23.6	0.6	0.8	0.6	0.1	0.8	1.3
PH	7.4	7.0	7.4	7.1	7.6	7.4	7.5	7.6	7.6	5.3	6.3	5.4	5.4	5.7	6.4
NH4 (ppm)	15.8	11.8	—	24.2	19.6	13.5	17.5	6.6	7.2	37.0	17.4	16.1	13.1	31.9	10.7
NO3 (ppm)	13.5	18.6	—	20.4	7.2	10.5	12.0	10.3	11.2	10.2	16.8	12.7	13.3	16.3	13.5
P (ppm)	13.0	16.0	—	14.0	10.0	11.0	12.0	10.0	10.0	4.0	1.0	3.0	2.0	4.0	2.0
K (ppm)	448	485	—	491	51	258	212	349	386	411	578	221	195	220	172
CA (ppm)	8470	7700	—	5476	1910	6325	6490	6353	4699	3456	6336	4366	5199	4736	5550
MG (ppm)	105	355	—	385	118	126	377	60	95	883	1132	255	311	326	265
THAW (cm)	31	36	30	34	51	35	31	40	32	25	19	27	27	30	29

RESULTS AND DISCUSSION

Effects of loess on the substrate characteristics of wet tundra downwind from the Sagavanirktok River

Organic matter

The results of the regression analysis of the soil variables versus distance from the river are in Table 33. The most direct effect of loess is the dilution of organic matter in the peat with a consequent increase in organic percentages toward the west (Fig. 45). Some wet soils in the eastern part of the region are high enough in mineral material that they fail to qualify as histosols according to the criteria of the United States soil taxonomy (Parkinson 1978). Wet soils in the western and northern parts of the region are relatively high in organic matter. In this small sample of wet tundra sites, the organic content varies from 18% near the Sagavanirktok River to 43% in the vicinity of Angel Pingo (Fig. 34). Outside the area of loess influence the organic content is considerably higher, with a maximum of 70% near the coast. Values in the Pad F vicinity are intermediate between values at the coast and values to the south, indicating, as expected, that there is some fallout of mineral materials north of the main area of loess deposition,

Table 33. Coefficients for linear regression equations for selected soil variables as functions of the distance from the Sagavanirktok River. The data are for the wet sites only. *R* is Pearson's product moment correlation coefficient, *a* is the *Y* intercept, *b* is the slope, and S.E. is the standard error of *Y*.

	R	*a*	*b*	*S.E.*
SAND	-0.856	34.0	-1.48	3.98
SILT	0.762	54.4	0.96	2.90
CLAY	0.921	11.7	0.52	1.29
ORGMAT	0.762	14.2	1.31	3.52
BDEN	-0.812	0 7	-0.03	0.075
SMOIS77	0.714	52.7	14.4	41.4
FLDCAP	0.730	36.8	2.74	7.69
WILTPT	0.806	20.0	3.24	8.24
AVH2O	-0.516	16.8	-0.50	1.98
HYGMOIS	0.710	2.2	0.19	0.55
H2OABSN	0.732	104.8	9.22	25.77
CO3	-0.804	28.4	-0.99	2.51
PH	-0.880	7.8	-0.03	0.07
NH4	0.127	13.2	0.12	2.13
NO3	0.968	5.5	0.66	1.57
P	0.866	8.7	0.29	0.78
K	0.887	96.1	21.4	55.8
CA	0.660	3624	202.2	708.7
MG	0.620	49.1	13.5	50.2
THAW	-0.589	42.9	-0.63	2.2

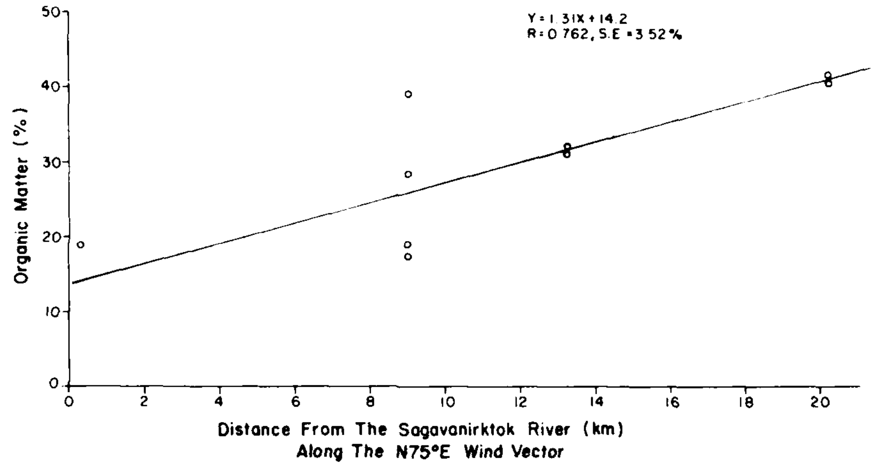


Figure 45. Soil organic matter downwind from the Sagavanirktok River. The data are from nine equivalent wet tundra plots within the main area of loess deposition.

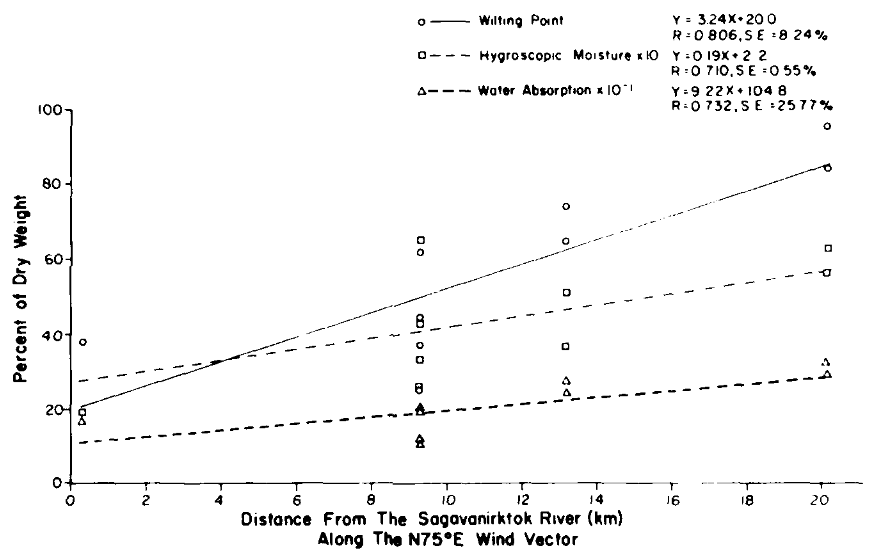


Figure 46. Soil water retention downwind from the Sagavanirktok River. The data are from nine equivalent wet tundra plots within the main area of loess deposition.

that is, in areas not directly downwind from the Sagavanirktok River.

The changes in the percentage of organic matter affect a number of other factors. The bulk densities of wet soils decrease downwind because they have less of the heavier mineral materials; the water retention of the soil generally improves as indicated by the scattergrams for wilting point, hygroscopic moisture and water absorption (Fig. 46). Bulk densities in wet sites near the Sagavanirktok dunes are quite high. A value of 0.89 g cm^{-3} was recorded in a low-centered polygon immediately west of the dunes, but values drop off quickly towards the west, with between 0.31 and 0.51 g cm^{-3} at Drill Site 2. In the wet acidic tundra areas, bulk densities vary between 0.12 and 0.31 g cm^{-3} (Table 32).

Bulk density, in turn, has an effect on the depth of thaw (Fig. 47). Near the dunes, thaw in wet sites can exceed 50 cm, whereas at Pad F and the coast, thaw did not exceed 30 cm in similar sites. Decreased thaw at the coast, however, is also partially due to lower temperatures. The annual sum of thaw degree-days at West Dock is only about half that in most of the mapped region (Table 1).

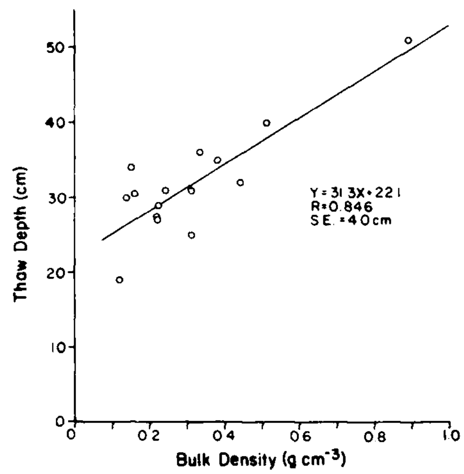


Figure 47. Thaw depth vs soil bulk density for 15 wet tundra sites.

Soil pH

The loess also has a major impact on soil pH because of its high carbonate content. Wet tundra in most arctic regions is characteristically acidic because soluble bases leach from the soil and organic acids accumulate. In areas at Prudhoe Bay with current loess fall, the soils remain basic because of the continual deposition of wind-blown, carbonate-rich silts. Soil pH values as high as 8.4 have been recorded in dry sands at the Sagavanirktok River dunes. The pH in a nearby wet site was 7.6. Westward, values decrease to about 7.0 in the vicinity of Angel Pingo, 20 km from the river.

Soils outside the area of current loess fall are typically more acidic. A line drawn from the mouth of the Sagavanirktok River in the direction of the main summer winds fairly accurately divides the areas of wet alkaline and wet acidic tundras east of the Kuparuk River (Fig. 44). Figure 48 shows the decrease in carbonates and pH along this line. It is likely that these are not linear relationships, but there are not sufficient data to justify using an alternative equation. North of the loess area, wet nonriparian tundra is consistently acidic (Fig. 44, Table 32). A soil pH of 5.0 was measured near the West Dock. The lower values are due to higher organic content and especially to lower carbonate concentration.

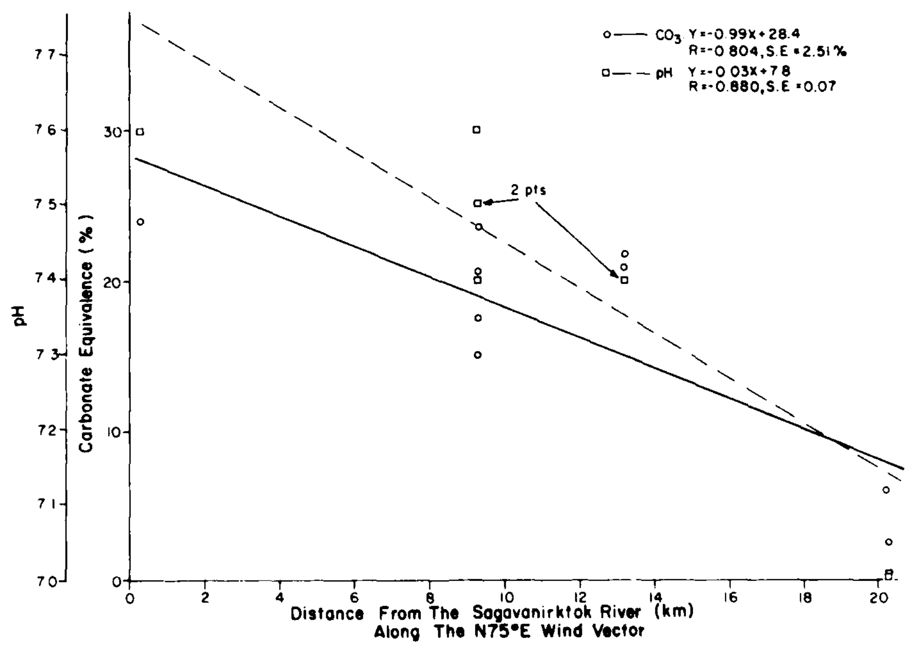


Figure 48. Carbonate equivalence and soil pH downwind from the Sagavanirktok River. The data are from nine equivalent wet tundra sites within the main area of loess deposition.

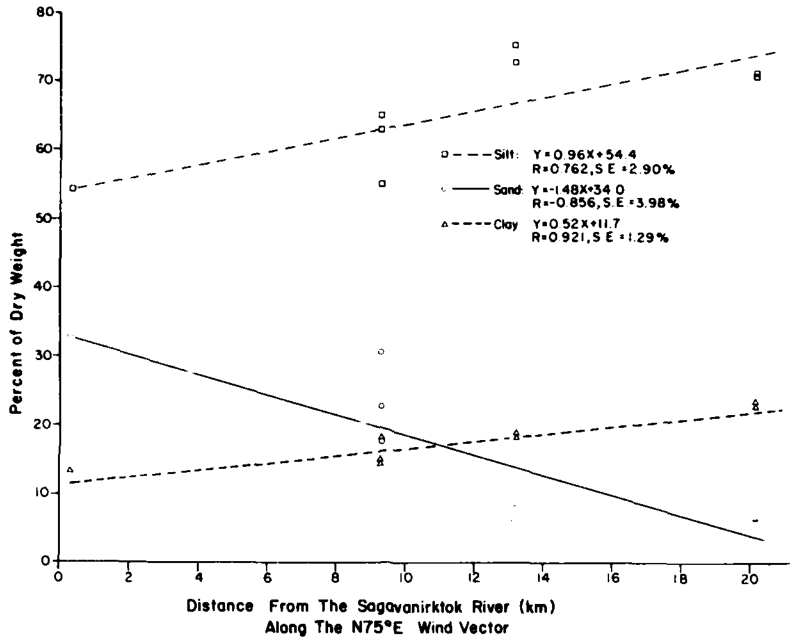


Figure 49. Percentages of sand, silt and clay downwind from the Sagavanirktok River. The data are from eight equivalent wet tundra plots within the main area of loess deposition.

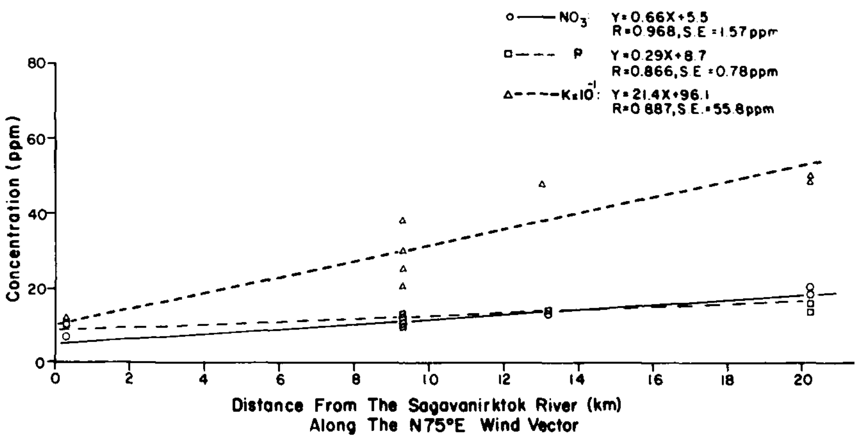


Figure 50. Concentrations of nitrate-nitrogen, phosphorus and potassium downwind from the Sagavanirktok River. The data are from eight equivalent wet tundra plots within the main area of loess deposition.

It appears that soil pH values are high (at least in upland microsites) much farther downwind than previously suspected. Soils in moist upland areas near the Ugnuravik River, over 60 km downwind from the Sagavanirktok River, have pHs near 7.* Soils are alkaline along all the streams and rivers that have alluvium eroded from calcareous Gubik materials.

*Personal communication with K. Everett, The Ohio State University, 1981.

Soil particle size

The particle sizes of the fraction of the soil less than 2 mm also change with distance from the river (Fig. 49). The percentage of sand drops from over 30% near the dunes to less than 10% in the Angel Pingo vicinity. The sand percentages are also high at the West Dock site because of windblown beach sand. Bilgin (1975) and Parkinson (1978) also found high sand percentages in wet areas along the Kuparuk River below the highest

Table 34. Significant correlations between soil nutrients and other environmental variables. Entries are listed in order of highest significance and then highest *R* value. Numbers in parentheses are Pearson's *R*. Starred (*) values are correlated at the 0.01 level; others are correlated at the 0.05 level.

NH4	H2ODPTH (0.4990*), SMOIS77 (0.3695*), ORGMAT (0.3594*), PH (-0.3521*), CLAY (0.3931), WDIST (0.3003), CRYOREG (-0.2481), MG (0.2394), THAW77 (-0.2212), SAGDIS (0.2088), CO3 (-0.2071)
NO3	CA (0.6061*), MG (5299*), SAGDIS (0.4649*), AVH2O (0.4492*), ORGMAT (0.3944*), CO3 (-0.3610), PH (-0.2888), THAW77 (-0.2699), FLICCOV (0.2374)
P	K (0.4601*), WDIST (0.3958*), PH (0.3753*), AVH2O (-0.3552*), TEMPREG (0.3466*), SAGDIS (-0.3464*), CA (0.3276), SOILCOV (-0.3021), MG (-0.2564), SILT (0.3236), SMOIS77 (0.2486), CO3 (0.2225), SLOPE (0.2073), ORGMAT (-0.2065), ERECDED (-0.2032)
K	CA (0.4672*), CRYOREG (-0.4640*), P (0.4601*), THAW77 (-0.2998), SOILCOV (-0.3010), MG (0.2764), BRYOCOV (0.2662), ORGMAT (0.2609), AVH2O (-0.2329), PROSDED (0.1909)
CA	NO3 (0.6061*), AVH2O (0.5488*), ORGMAT (0.5376*), K (0.4672*), THAW77 (-0.4648*), MG (0.4636*), SAGDIS (0.3941*), CRYOREG (-0.3528*), CO3 (-0.3555*), FLICCOV (0.3214), P (0.3276), SOILCOV (-0.3223), SMOIS (0.2913), SILT (0.3553), PH (-0.2580), PROSDED (0.2451), BRYOCOV (0.2234), SQR[illegible] (-0.2140)
MG	SAGDIS (0.6871*), ORGMAT (0.6870*), PH (-0.6176*), WDIST (-0.6097*), CO3 (-0.5825*), AVH2O (0.5536*), NO3 (0.5295*), CA (0.4636*), CLAY (0 4469*), TEMPREG (-0.4395*), SILT (-0.4378*), SMOIS77 (0.4287*), THAW77 (-0.3842*), K (0.2764), P (-0.2564), NH4 (0.2394), PROSDED (0.1902)

terraces. Silt and clay have corresponding increases toward the west.

Nutrients

It is assumed here that the higher sand and lower organic content tends to lower the cation exchange capacities in the eastern part of the region, which results in generally lower nutrient values. This is somewhat counteracted by the lower pH values in the west, which tend to reduce the base saturation levels. Overall, there is a general increase in nitrogen, phosphorus and potassium toward the west (Fig. 50). Since these are the limiting nutrients in most tundra environments, these differences are likely to have important effects on the vegetation. Several of the measured nutrients have distinct regional patterns that can be examined further in scattergrams of soil pH versus nutrient concentrations for all the study plots and by correlating the nutrients and the other environmental variables (Table 34).

Ammonium does not show distinct regional patterns of concentration (Fig. 51). The moisture status of the microsite appears to be the overriding control, as indicated by the highly significant correlations with water depth, soil moisture and organic matter (Table 34).

Nitrates show increased concentrations toward the west (Fig. 52) that appear to be primarily a function of higher organic matter, particularly in the more well-drained sites, as indicated by the correlations with available water and organic matter (Table 34). The highest nitrate values generally occur in the drier organic soils with pH values in the range from 6.2 to 7.0.

Phosphorus shows a strong regional pattern, with increased values toward the west (Fig. 53) but not towards the north, where the soils are apparently excessively acidic. At low pH (less than about 6) phosphorus forms insoluble compounds that are a result of the increased activity of iron, aluminum and manganese, and at pHs above 7 phosphates react with calcium and calcium carbonates to form complex insoluble calcium phosphates (Brady 1974). Phosphorus shows highly significant correlations with soil pH, distance from the coast, and distance from the Sagavanirktok River (Table 34). The correlations with available water,

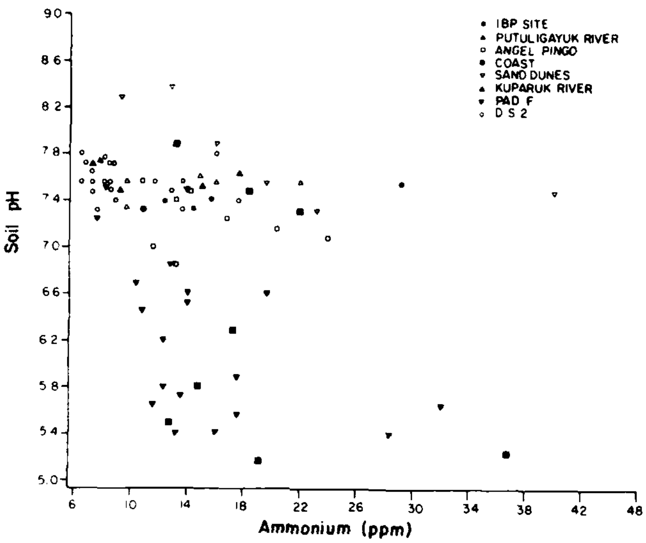


Figure 51. Soil pH vs ammonium concentration. The data points are from 92 permanent study plots. No distinct regional patterns are apparent from these data.

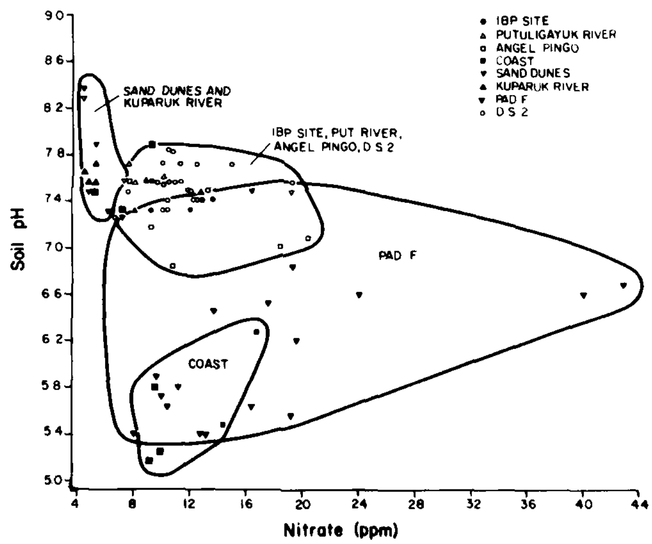


Figure 52. Soil pH vs nitrate concentration. Weak regional patterns permit organizing the data into geographical clusters.

soil moisture, organic matter and slope point to the equally important role of microscale factors for this nutrient.

Potassium values tend to increase toward the west, which is probably a function of the higher exchange capacity of these finer soils. Sandy soils near the Sagavanirktok and Kuparuk rivers are exceptionally low in potassium (Fig. 54). The low-pH soils at Pad F and the coast do not show significant correlations with available potassium. However, the two sites do show distinct clusters; the coastal site has higher potassium values than Pad F. Potassium shows rather weak correlations with mesoscale factors (Table 34). Microscale factors appear to be more important. The negative correlations with frost stirring and cover of bare

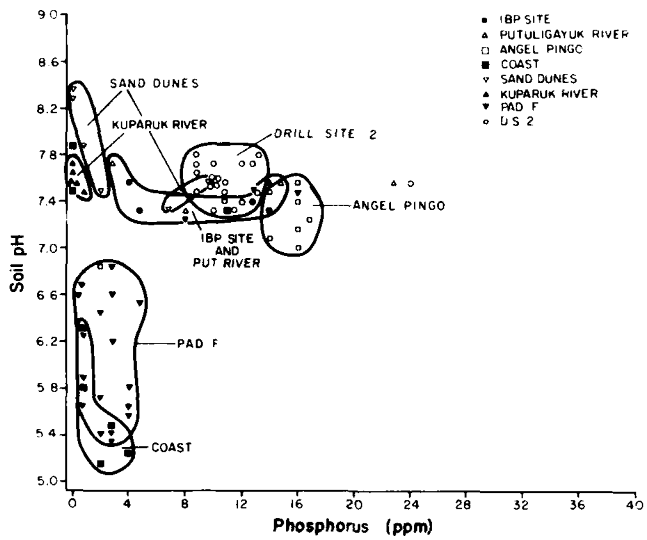


Figure 53. Soil pH vs phosphorus concentration. A weak correlation exists between the variables within the alkaline area. Note the very low phosphorus levels in the sandy soils near the sand dunes and the Kuparuk River and also in the acidic soil at Pad F and the coast.

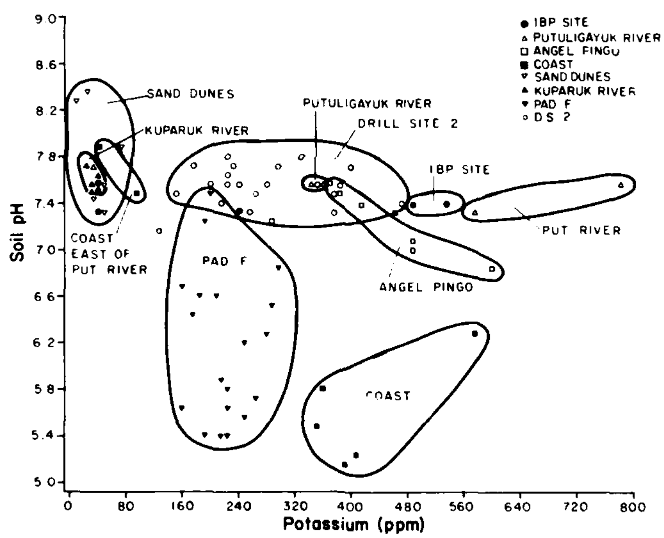


Figure 54. Soil pH vs potassium concentration. The definite regional clusters are mainly a function of distance from the Sagavanirktok River.

soil, and the positive correlations with bryophyte cover and prostrate dead vegetation suggest that vegetative cover and potassium levels are linked.

Calcium is one of the most easily leached cations. As a result the values for this cation are quite low in the sandy soils near the rivers. Calcium increases markedly downwind from the Sagavanirktok River in response to the higher exchange capacity associated with more organic soils with finer mineral fractions (Fig. 55 and Table 34). The result is an interesting situation in which there is an increase in calcium with a corresponding decrease

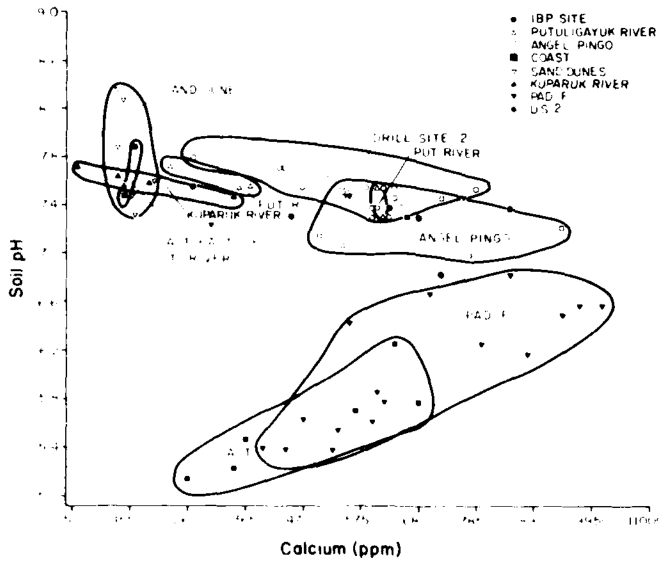


Figure 55. Soil pH vs calcium concentration. Distinct clusters represent the major study sites.

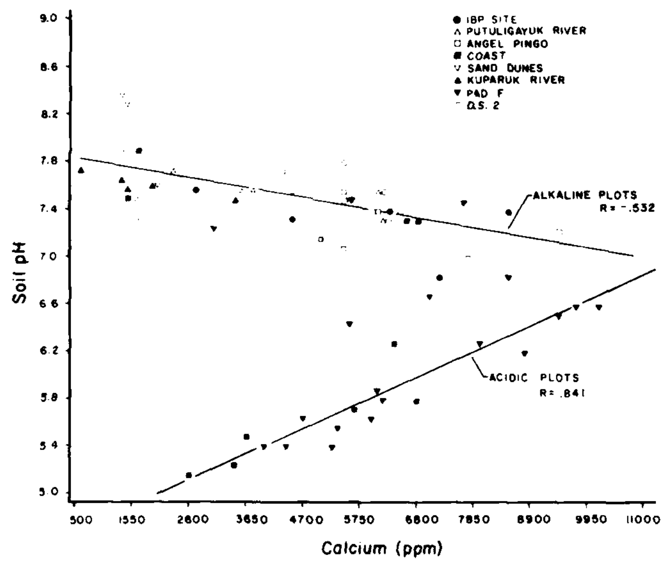


Figure 56. Regressions of calcium concentration vs soil pH for the acidic and alkaline tundra areas. The highest calcium levels are in soils with pHs near 7.

in pH and carbonates. However, this is true only within the area of heavy loess deposition. To the north, at Pad F and the coast, soils show a strong positive correlation between calcium and soil pH (Fig. 56). This is due to the lower base saturation in the acidic soils. The highest calcium levels are found in soils with near-neutral pH. This is somewhat similar to the case with nitrates (Fig. 52), except the calcium trends are more evident. The strong correlation between calcium and nitrates (Table 34) points to the similarity of their patterns of concentration.

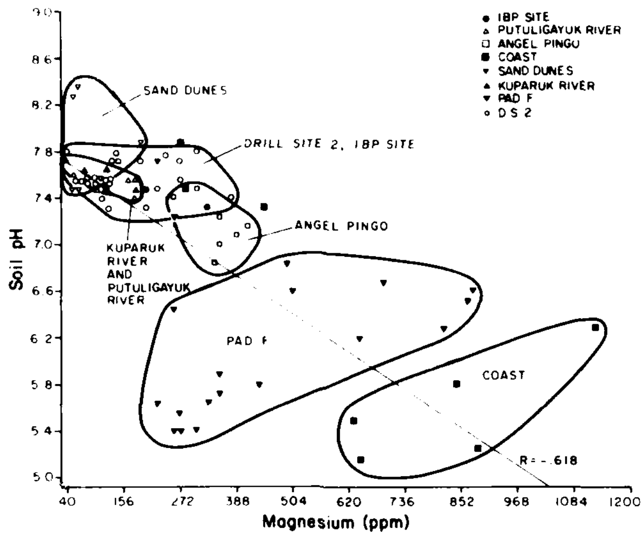


Figure 57. Soil pH vs magnesium concentration. A strong linear correlation exists between these two variables.

Calcium shows a strong correlation with the distance from the Sagavanirktok River (Table 34); the controlling factor appears to be the organic percentages. The positive correlations with prostrate dead vegetation, bryophyte cover and fruticose and foliose lichens, and the negative correlations with frost stirring and cover of bare soil suggest that, as with potassium, the vegetative cover has a strong influence in keeping calcium near the surface. The strong negative correlation with thaw depth is most evident with calcium but also occurs with most other nutrients. The strength of the thaw depth correlation apparently reflects the ease with which the particular nutrient is leached in the deeply thawed, often sandy soils.

Magnesium shows the strongest regional correlation of any of the measured nutrients (Fig. 57). It has high positive correlations with the distance from the Sagavanirktok River, available water, nitrates, organic matter and clay, and strong negative correlations with distance from the ocean, temperature regime, soil pH, silt and carbonates (Table 34). Magnesium concentrations increase with lower pH, whereas calcium concentrations decrease. Apparently magnesium responds somewhat differently to pH than does calcium. It is not displaced in mass from the exchange complex until the pH reaches a value that is somewhat lower than that required for calcium. Any losses of magnesium in the Prudhoe Bay soils due to lowered base saturation are apparently more than compensated for by the higher exchange capacities due to more organic matter.

Effects of the loess gradient on vegetation

The response of individual plant taxa to mesoscale variables was examined in the same manner used for microscale variables. The variables considered here are distance from the Sagavanirktok River, carbonates, pH, soil texture, calcium and magnesium. Some of the microscale parameters discussed in Chapter 3 also vary in response to mesoscale phenomena (e.g. organic matter) and vice versa (e.g. pH). The overlap between the microscale and mesoscale should be apparent from the preceding discussion in this chapter and Chapter 3. No attempt is made here to isolate mesoscale and microscale components for each of the variables.

Tables 35–42 are lists of plants correlated with 1) distance from the Sagavanirktok River, 2) soil pH, 3) carbonate equivalence, 4) calcium, 5) magnesium, 6) sand, 7) silt and 8) clay. Table 43 shows the degree of similarity between these lists. These lists do not tell the whole story of the loess gradient. The correlations apply to linear relationships. Some of the relationships are likely to be better described by curvilinear equations and may not be significant with simple tests used here.

The lists indicate that loess has a generally detrimental effect on the floristic diversity of the tun-

Table 35. Plants correlated with distance from the Sagavanirktok River measured in the direction of the wind (SAGDIS). Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	Negative correlations
Vascular plants	**Vascular plants**
Carex misandra	*Artemisia borealis*
Carex rariflora	*Chrysanthemum integrifolium*
Draba lactea	*Equisetum variegatum*
Eriophorum scheuchzeri	*Minuartia arctica*
*Luzula arctica**	*Saxifraga oppositifolia*
Poa arctica	
Salix planifolia	**Bryophytes**
Saussurea angustifolia	*Catoscopium nigritum*
Saxifraga foliolosa	*Ditrichum flexicaule*
Stelleria humifusa	*Hypnum bambergeri*
Bryophytes	
Anastrophyllum minutum	
Gymnocolea inflata	
Ptilidium ciliare	
Scapania simmonsii	
Aulacomnium acuminatum	
*Dicranum angustum**	
Dicranum elongatum	
Distichium inclinatum	
Hylocomium splendens	
Mnium andrewsianum	
Mnium blyttii	
Oncophorus wahlenbergii	
Polytrichastrum alpinum	
Polytrichaceae	
Pohlia sp.	
Lichens	
Alectoria nigricans	
Caloplaca sp.	
*Cetraria cucullata**	
Cladonia phyllophora	
Cladonia pocillum	
Cornicularia divergens	
Lecidea vernalis	
Ochrolechia frigida	
Peltigera aphthosa	

Table 36. Plants correlated with soil pH (PH). Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	Negative correlations
Vascular plants	**Vascular plants**
Androsace chamaejasme	*Carex aquatilis*
Armeria maritima	*Carex misandra*
Artemisia borealis	*Carex rariflora*
Carex rupestris	*Draba lactea*
Chrysanthemum integrifolium	*Eriophorum scheuchzeri*
Dryas integrifolia	*Luzula arctica*
Minuartia arctica	*Pedicularis lanata*
Saxifraga oppositifolia	*Petasites frigidus*
	*Salix planifolia**
Bryophytes	*Saxifraga cernua*
Ditrichum flexicaule	*Saxifraga foliolosa*
Drepanocladus uncinatus	
	Bryophytes
	Gymnocolea inflata
	Lophozia heterocolpa
	Scapania simmonsii
	Aulacomnium acuminatum
	*Dicranum angustum**
	Dicranum elongatum
	Mnium andrewsianum
	Mnium blyttii
	Mnium rugicum
	Oncophorus wahlenbergii
	Pohlia nutans
	Polytrichastrum alpinum
	Lichens
	Alectoria nigricans
	*Cladonia gracilis**
	Cladonia lepidota
	*Cladonia phyllophora**
	Dactylina ramulosa
	Gyalecta foveolaris
	Ochrolechia frigida f. *thelephoroides*

dra. Thirty-four taxa show significant positive correlations with the distance from the Sagavanirktok River (Table 35). The occurrence and/or cover of these plants apparently increases with decreased quantities of loess. Conversely only eight taxa show negative correlations with distance from the river. Most of the correlations appear to be mainly a function of soil pH and availability of nutrients. Thirty taxa show negative correlations with soil pH, while only 10 show positive correlations (Table 36). There is about a 60% overlap between species correlated with distance to the river and those correlated with pH or carbonates (Tables 37 and 43).

Organic matter and clay are two variables related to nutrient availability; both increase away from the river. There are 25 taxa positively correlated with organic matter and only 15 negatively correlated (Table 16). With clay (Table 38) there are 34 positive correlations and no negative correlations. The lists of taxa correlated to organic matter and clay both have more than 40% overlap with the list correlated with distance from the river (Table 43). There is also a 60% overlap between taxa correlated with pH and those correlated with organic matter.

Two nutrients that show definite increases downwind in the loess gradient are calcium and

Table 39. Plants correlated with total calcium (CA). Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	*Negative correlations*
Vascular plants	**Vascular plants**
Cardamine digitata	*Androsace chamaejasme*
Carex bigelowii	*Anemone parviflora*
Draba alpina	*Armeria maritima*
Eriophorum vaginatum	*Artemisia borealis*
Festuca baffinensis	*Artemisia glomerata*
Juncus biglumis	*Deschampsia caespitosa*
Luzula confusa	*Equisetum variegatum*
Minuartia rubella	*Lesquerella arctica*
Papaver macounii	*Polemonium boreale*
Pedicularis capitata	*Salix ovalifolia*
Poa glauca	
Salix reticulata	
Saussurea angustifolia	
Silene wahlbergella	
Stellaria laeta	
Bryophytes	
Lophozia binsteadii	
Ptilidium ciliare	
Encalypta alpina	
Funaria arctica	
Hylocomium splendens	
Meesia uliginosa	
Rhytidium rugosum	
Lichens	
Cetraria cucullata	
Cetraria islandica	
Cetraria nivalis	
Cornicularia divergens	
Dactylina arctica	
Ochrolechia frigida	
Peltigera aphthosa	

Table 40. Plants correlated with total magnesium (MG). Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	*Negative correlations*
Vascular plants	**Vascular plant**
Caltha palustris	*Equisetum variegatum*
Cardamine digitata	
Draba lactea	**Bryophyte**
Eriophorum scheuchzeri	*Ditrichum flexicaule*
Festuca baffinensis	
*Hierochloe pauciflora**	
Luzula confusa	
Pedicularis capitata	
Poa arctica	
Poa glauca	
Potentilla uniflora	
Ranunculus pallasii	
Salix planifolia	
Saussurea angustifolia	
Saxifraga cernua	
*Stellaria laeta**	
Utricularia vulgaris	
Bryophytes	
Blepharostoma trichophyllum	
Bryum wrightii	
Dicranum angustum	
Funaria arctica	
Mnium andrewsianum	
*Mnium blyttii**	
Polytrichastrum alpinum	
Lichens	
Cladonia pocillum	
Cornicularia divergens	
Hypogymnia subobscura	
Pertusaria dactylina	
Thamnolia subuliformis	

Saxifraga oppositifolia, Carex scirpoidea and *Chrysanthemum integrifolium* (Sórenson 1941, Porsild 1957, Polunin 1959, Bamberg and Major 1968, Hultén 1968), do not show positive correlations with calcium but do show positive correlations with carbonates and/or pH. This indicates that, at least within the Prudhoe Bay region, these plants exhibit more of a basophilic response. There are, in contrast, numerous plants that do exhibit positive correlations with calcium (Table 39). The plants with negative correlations with calcium should definitely not be considered calciphobes, since calcium levels are high throughout the region. They may even be calciphiles when their total distribution is considered (e.g. *Lesquerella arctica, Polemonium boreale, Androsace chamaejasme*), but within the Prudhoe Bay region other ecological factors apparently limit their distribution to the relatively calcium-poor sites.

Several vascular taxa are nearly limited within the region to acidic sites. These include *Salix planifolia* ssp. *pulchra, Saxifraga foliolosa, Luzula arctica, Polygonum bistorta, Vaccinium vitis-idaea* and *Carex rariflora*. Others that are not limited to, but that are much more common in, acidic areas include *Carex misandra, Eriophorum scheuchzeri, Ranunculus pallasii, Saussurea angustifolia* and *Saxifraga cernua*.

On the other hand, there are very few taxa limited to the wet alkaline areas (Fig. 43). A few taxa, such as *Salix lanata, Dryas integrifolia, Saxifraga oppositifolia, Chrysanthemum integrifolium, Equisetum variegatum, Minuartia arctica, Ditrichum flexicaule, Hypnum bambergeri, Catoscopium nigritum* and *Drepanocladus uncinatus*, appear to be more common in the loess area.

Numerous mosses typically found in mineral-rich areas are abundant throughout the region,

Table 37. Plants correlated with the percentage of carbonates (CO3). Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	*Negative correlations*
Vascular plants	**Vascular plants**
Androsace chamaejasme	*Carex misandra*
Artemisia borealis	*Draba lactea*
Carex scirpoidea	*Eriophorum scheuchzeri*
Chrysanthemum integrifolium	*Luzula arctica*
Elymus arenarius	*Salix planifolia*
Kobresia myosuroides	
Minuartia arctica	**Bryophytes**
Saxifraga oppositifolia	*Harpanthus flotowianus*
	Scapania simmonsii
Bryophyte	*Dicranum angustum*
Ditrichum flexicaule	*Distichium inclinatum*
	Mnium blyttii
Lichen	*Oncophorus wahlenbergii*
Fulgensia bracteata	
	Lichens
	Alectoria nigricans
	Caloplaca sp.
	Cetraria cucullata
	Cetraria islandica
	Cetraria nivalis
	*Cladonia gracilis**
	Cladonia phyllophora
	Lecidea vernalis

Table 38. Plants correlated with the percentage of clay (CLAY). Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	*Negative correlations*
Vascular plants	
Arctophila fulva	
*Eriophorum angustifolium**	
Eriophorum scheuchzeri	
Eriophorum vaginatum	
Luzula arctica	
Pedicularis lanata	
Salix planifolia	
Saxifraga cernua	
Utricularia vulgaris	
Bryophytes	
Anastrophyllum minutum	
Gymnocolea inflata	
Lophozia binsteadii	
Lophozia quadriloba	
Ptilidium ciliare	
Radula prolifera	
Scapania simmonsii	
*Dicranum angustum**	
*Dicranum elongatum**	
Distichium inclinatum	
Fissidens osmundoides	
Hylocomium splendens	
*Mnium andrewsianum**	
Mnium blyttii	
Oncophorus wahlenbergii	
Philonotis fontana	
*Polytrichastrum alpinum**	
Polytrichaceae	
Rhacomitrium lanuginosum	
Tortella arctica	
Lichens	
Cladonia gracilis	
Dactylina arctica	
Ochrolechia frigida f. *thelephoroides*	
Psoroma hypnorum	
Solorina sp.	
Stereocaulon alpinum	

magnesium. For calcium there are 29 taxa that show positive correlations and 10 with negative correlations (Table 39). For magnesium there are 29 with positive correlations and only 2 with negative correlations (Table 40). There is a 25% overlap between taxa correlated with calcium and taxa correlated with magnesium (Table 43).

Sand percentages decrease away from the river, while silt increases. There are 15 taxa with negative correlations with sand and 7 with positive correlations (Table 41). For silt there are 15 taxa with positive correlations and 8 with negative correlations (Table 42). There is a 71% overlap between taxa correlated with sand and those correlated with silt (Table 43). Those positively correlated with sand are generally negatively correlated with silt.

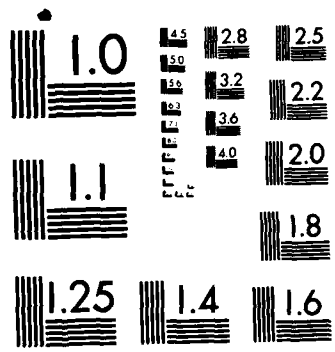
Thus, it appears that high carbonate content, dilution of organic matter, and lower nutrient status are responsible for most of the negative effects of loess. In addition there is sometimes a smothering effect of carbonate precipitates. Wet, highly alkaline sites often have a thick deposit of marl on the surface. In small ponds and water-filled thermokarst pits, the marl deposits are sometimes thick enough to hamper or prevent the growth of mosses and sedges.

The effect of calcium-rich substrates has been noted throughout the arctic-alpine regions (e.g. Fernald 1907, Acock 1940, Coombe and White 1951, Degelius 1955, Sjors 1959, Drew and Shanks 1965). The abundance of calciphilic plants at Prudhoe Bay has been noted by numerous authors (Rastorfer et al. 1973, Steere 1978, Murray 1978), but it is interesting that the calcium gradient actually opposes the loess gradient. Calcium concentrations generally increase downwind from the river, in contrast to carbonate equivalences and soil pH, which decrease downwind.

At Prudhoe Bay, some plants that are generally considered calciphiles, such as *Dryas integrifolia*,

AD-A162 022 VEGETATION AND ENVIRONMENTAL GRADIENTS OF THE PRUDHOE BAY REGION ALASKA(U) COLD REGIONS RESEARCH AND ENGINEERING LAB HANOVER NH D A WALKER SEP 85 2/3

UNCLASSIFIED CRREL-85-14 F/G 6/3 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Table 41. Plants correlated with the percentage of sand (SAND). Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	*Negative correlations*
Vascular plants	**Vascular plant**
Draba lactea	*Cardamine digitata*
Hierochloe pauciflora	*Carex saxatilis*
Polemonium boreale	*Eriophorum angustifolium*
Stellaria humifusa	*Eutrema edwardsii*
	Salix reticulata
Lichens	*Senecio atropurpureus*
Cladonia phyllophora	
Evernia perfragilis	**Bryophytes**
Hypogymnia subobscura	*Radula prolifera*
	Scapania simmonsii
	Ditrichum flexicaule
	Encalypta procera
	Meesia uliginosa
	Orthothecium chryseum
	Scorpidium scorpioides
	Tomenthypnum nitens
	Lichen
	Dactylina arctica

Table 42. Plants correlated with the percentage of silt (SILT). Starred (*) entries are correlated at the 0.001 level; others are correlated at the 0.05 level.

Positive correlations	*Negative correlations*
Vascular plants	**Vascular plant**
Cardamine digitata	*Draba lactea*
Carex rotundata	*Hierochloe pauciflora*
Carex saxatilis	*Salix planifolia*
Eutrema edwardsii	*Stellaria humifusa*
Pedicularis sudetica	
Senecio atropurpureus	**Bryophyte**
	Aulacomnium palustre
Bryophytes	
Catoscopium nigritum	**Lichens**
Cinclidium arcticum	*Cladonia phyllophora*
Ditrichum flexicaule	*Evernia perfragilis*
Encalpyta procera	*Hypogymnia subobscura*
Hypnum bambergeri	
Meesia uliginosa	
Orthothecium chryseum	
Scorpidium scorpioides	
Tomenthypnum nitens	

Table 43. Matrix of Sørenson's coefficient of similarity (C) between lists of plant taxa correlated with loess-related variables. $C = 2w/(a+b)$, where w is the number of taxa shared between the two lists, a is the number of taxa in the first list, and b is the number of taxa in the second list. This table shows the overlap between the various plant lists (Tables 35–42).

	No. of taxa correlated	*SAGDIS*	*CO3*	*PH*	*CA*	*MG*	*SAND*	*SILT*	*CLAY*	*ORGMAT*
SAGDIS	44	1.000								
CO3	30	0.595	1.000							
PH	40	0.619	0.514	1.000						
CA	39	0.193	0.116	0.101	1.000					
MG	32	0.368	0.225	0.278	0.254	1.000				
SAND	22	0.151	0.154	0.097	0.164	0.148	1.000			
SILT	23	0.159	0.189	0.126	0.065	0.218	0.711	1.000		
CLAY	35	0.456	0.000	0.000	0.162	0.1818	0.000	0.000	1.000	
ORGMAT	39	0.410	0.202	0.607	0.179	0.338	0.098	0.161	0.216	1.000

e.g. *Drepanocladus brevifolius, Scorpidium scorpioides, Tomenthypnum nitens, Hypnum procerrimum* and *Orthothecium chryseum.* Steere (1978) commented on the abundance of calciphilic mosses and the scarcity of such acidophiles as *Sphagnum, Dicranum* and members of the family Polytrichaceae. So far, *Sphagnum* has been found only in the northernmost areas of the region (Spatt 1983). This is apparently due to the high concentrations of calcium in most of the Prudhoe Bay region. Calcium is generally considered toxic to *Sphagnum.* Clymo (1973) has found reduced growth of *Sphagnum* with calcium concentrations as low as 10 ppm; this level is far exceeded throughout the region. *Dicranum* and Polytrichaceae are found in abundance only in the region of acidic tundra, as are other bryophytes, including *Ptilidium ciliare, Hylocomium splendens, Distichium inclinatum, Oncophorus wahlenbergii, Mnium blyttii, Scapania simmonsii, Lophozia* sp. and numerous other liverworts. Rastorfer et al. (1973) noted the exceptionally rich bryoflora in the Pad F vicinity, particularly for members of the liverwort family Lophoziaceae. Rastorfer found it difficult to account for the richness of the Pad F site because of his lack of soils data. The data here suggest that the higher percentages of clay in the acidic tundra may be an important factor for the

liverworts (Table 38). Seven hepatics, *Anastrophyllum minutum, Gymnocolea inflata, Lophozia binsteadii, L. quadriloba, Ptilidium ciliare, Scapania simmonsii* and *Radula prolifera,* show positive correlations with clay percentages.

Lichens also exhibit a positive response to reduced loess concentrations. The Cladoniaceae in particular are more abundant in the acidic region. *Cladonia gracilis, C. lepidota, C. phyllophora, C. squamosa* and probably many others are much more common far downwind from the Sagavanirktok River. Other lichens that increase downwind include *Alectoria nigricans, Cornicularia divergens, Dactylina ramulosa, Psoroma hypnorum* and *Stereocaulon alpinum.* One lichen that is particularly noticeable in acidic areas is *Ochrolechia frigida* f. *thelophoroides,* which is an interesting fruticose form of the normally crustose *O. frigida* and is abundant at the coast and on mesic strangmoor features near Pad F. *Lecidea ramulosa* is likewise a lichen that occurs in fairly wet acidic sites and has not been recorded in alkaline areas.

Implications of the loess gradient with respect to road dust

The contrasts between loess and non-loess areas have important implications with respect to recent studies involving the effects of road dust on arctic tundra vegetation (Spatt and Miller 1979, Werbe 1980, Everett 1980b). Loess impact can be considered more long term and more widespread but locally less severe than impact due to road dust. Observations of roadside sites in the Prudhoe Bay region have shown that only a few taxa can tolerate the heavy dust loads. Cryptogams in particular are eliminated in roadside areas, as are most small dicotyledons. The loss of moss cover has contributed to increased thaw near the road and has resulted in the thermokarst of polygon troughs in many roadside sites. This has occurred in a tundra that is somewhat preadapted to this type of impact because of the loess deposits. Heavy road dust in an acidic, *Sphagnum*-rich tundra is likely to have an even more severe impact because most of the native species are adapted to a nutrient-poor environment and could not tolerate sudden heavy dust loads. This has occurred in a few upland tundra sites of the foothills along the trans-Alaska pipeline haul road (Everett 1980b).

SUMMARY

The loess gradient at Prudhoe Bay is a subtle one that extends at least 60 km downwind from the Sagavanirktok River. Within the Prudhoe Bay

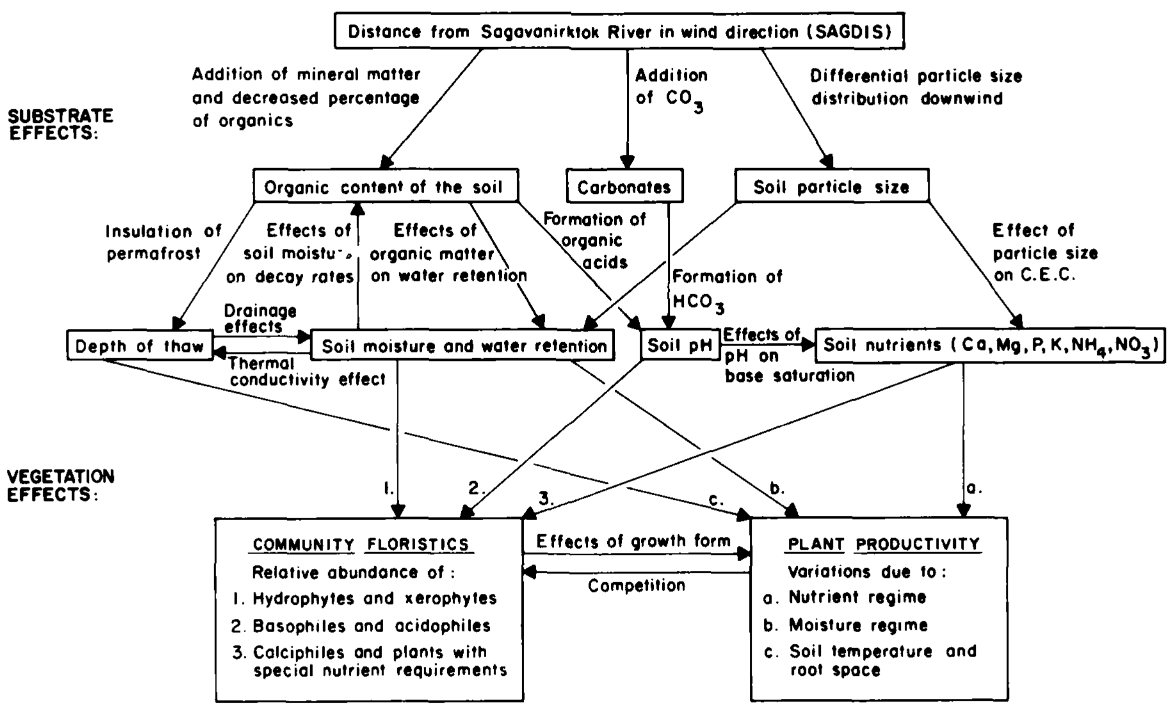


Figure 58. Block diagram of the loess gradient effects.

region there are numerous substrate effects, which are summarized in Figure 58. The three main effects of loess are 1) the addition of mineral matter, 2) the addition of carbonates, and 3) the differential distribution of soil particle sizes downwind from the river. The addition of mineral matter decreases the percentage of organic matter in the soil, which affects the water retention properties of the soil, the soil pH and the depth of thaw. The addition of carbonates raises the soil pH, which affects the concentration of soil nutrients through changes in the base saturation. The changes in soil particle size affect soil moisture properties and the concentration of soil nutrients. The soils near the river have lower organic content, higher pH and higher sand content. The soil properties have complex interactions that affect soil drainage, soil temperature, thermal conductivity, decay rates and nutrient regimes. The flora and productivity of the tundra downwind from the river are reflections of these gradients.

CHAPTER 5. MACROSCALE GRADIENTS

Cantlon (1961) considered macroscale patterns to be those associated with large regional phenomena such as the presence of the Arctic Coast and the Brooks Range. Often the influences are subtle and difficult to detect without reference to much broader regions than the local area of study. At Prudhoe Bay the coast has a major influence on the vegetation because of the lower temperatures associated with the ice-covered Beaufort Sea and the Arctic Front (Conover 1960). The mountains to the south have less but significant influence.

The changes in vegetation associated with the cold maritime influence have been noted by numerous authors (Clebsch 1957, Cantlon 1961, Wiggins and Thomas 1962, Clebsch and Shanks 1968). Cantlon in particular noted that toward the coast there are fewer dwarf shrubs and poorer tussock tundra development. *Sphagnum* becomes less common, *Dupontia fisheri* becomes more common, and there is a gradual reduction in the number of plant species. He referred to the cold maritime tundra, the area north of the 7°C July normal isotherm, as the "littoral tundra" subzone. This may have been an unfortunate choice of a term because this "shore" tundra is not so much a result of the direct influence of the ocean, implied by the word "littoral," as it is a result of low temperatures. There is a band of salt-affected vegetation immediately adjacent to the coast that could more properly be termed "littoral tundra." Here there are several plant taxa, including *Carex subspathacea, Cochlearia officinalis, Stellaria humifusa, Puccinellia phryganodes, P. andersonii, Primula borealis* and *Mertensia maritima,* that are found almost exclusively in association with saltwater. In places this strip may extend a kilometer or more inland, especially where storm surges have flooded low-lying tundra areas. However, Cantlon's littoral tundra designation is retained here to refer to the wide band of coastal tundra within the 7°C July mean isotherm, and the term "saline tundra" is used for the much narrower band of salt-affected tundra.

According to Cantlon's descriptions, the Prudhoe Bay region north of the Deadhorse airport lies entirely within the area of littoral tundra. South of Deadhorse, especially on the gently rolling upland area along the east side of the Sagavanirktok River and also west of the Kuparuk River in the vicinity of the main Kuparuk airstrip, the vegetation is what Cantlon referred to as "typical tundra." Here there are extensive areas with cottongrass tussocks mixed with willows and ericaceous dwarf shrubs. Low shrubs are common along the streams.

Although the temperature gradient is very steep near the coast, it does not cause the visually dramatic changes in vegetation that are associated with other steep tempemature gradients, such as in mountainous regions. There is no abrupt reduction from tall trees to krummholz to low shrubs and finally to herbs that one sees near alpine treeline. Most of the growth form changes along the Arctic Slope temperature gradient are on a scale of a few centimeters.

In this chapter the effects of the temperature gradient are examined in two separate studies. The first is a floristic analysis. In this study the flora of the Prudhoe Bay region is divided into floristic units that are meaningful for treating several macroscale questions, such as the role of temperature and the importance of Asiatic, alpine and high Arctic influences in the total flora. The flora is also analyzed with respect to the moisture gradient.

The second study examines the temperature gradient with respect to the changes in stature of *Salix lanata* ssp. *richardsonii.* This willow grows abundantly on the open tundra and along riverbanks. Its height, particularly in riverine sites, appears to be closely correlated with the temperature gradient. Seven groups of *S. lanata* were examined along the 100-km transect from the coast to the southern edge of the coastal plain. The heights of the willows and sizes of the yearly growth rings are correlated with the variations in July mean temperature and the annual number of thaw degree-days. This study demontrates the variation in shrub growth forms in coastal plain ecosystems and their importance to various systems of vegetation zonation in northern Alaska.

FLORISTIC ANALYSIS

Plants have been collected in the Prudhoe Bay region only since 1971. In spite of this, the total known vascular flora is double that of Barrow, the nearest intensively studied coastal site. The reasons for this relatively large flora are several. First, the Prudhoe Bay region is not as limited to the immediate coastal vicinity as is Barrow. Most of the oil-field road network is several kilometers inland and is in a somewhat warmer, more lush environment. Another factor is the variety of microhabitats at Prudhoe Bay. Some of the most diverse areas, such as pingos and gravel river bars, do not have analogs at Barrow. A third factor is the variety of substrates at Prudhoe Bay, particularly variations in soil pH. Barrow has very few nonacidic areas; Prudhoe Bay has large areas of both alkaline and acidic tundras. Finally, the Prudhoe Bay region is larger than that at Barrow and the accessibility to diverse habitats is much better.

Appendix A contains a checklist of plants for the Prudhoe Bay region. The list includes 238 vascular plants, 25 hepatics, 115 mosses and 83 lichens. This represents all the plants known from Prudhoe Bay and Kuparuk oil fields. The collection sites are shown in Figure A1. There are 18 taxa from the Kuparuk field that have not been found within the Prudhoe Bay region as defined in Chapter 2. The list also contains 9 taxa reported by Hettinger* from a site just south of the Prudhoe Bay region. There is, however, some doubt that the site shown in Figure A1 is the exact location of the Hettinger collections, since some of the plants are not typical of the coastal plain and are actually alpine plants. It is likely that they were collected from a northern extension of Franklin Bluffs along the Sagavanirktok River. It is debatable whether they should be considered part of the flora of the main Prudhoe Bay region. The same is true for many of the plants collected from the Kuparuk field. However, Hettinger's collections and the Kuparuk plants are included in the floristic analysis since they help put the oil field in perspective with sites both to the west and south of the main road network. Hultén's (1968) distribution maps show another 41 taxa that could occur in the region (Table 44). It is likely that the final list for the main Prudhoe Bay oil field will be about 250 vascular taxa.

Table 45 compares the sizes of the floras from several arctic localities, principally in Alaska. Barrow and Cape Thompson are both coastal locations, although Cape Thompson is much farther south and has considerably higher summer temperatures. The large flora at Cape Thompson is due partly to higher temperatures, partly to diversity of habitat, and partly to the many Beringian endemics that are concentrated along the northwestern coast of Alaska (Johnson et al. 1966). The Cape Prince of Wales area, the westernmost extension of Alaska,† has a similar-sized vascular flora as that of Cape Thompson.

* List of Hettinger's 1973 collections supplied by D. Murray, University of Alaska Herbarium, 1980.

† Personal communication, T. Kelso, University of Alaska Herbarium, 1980.

Table 44. Additional vascular taxa that could occur at Prudhoe Bay according to Hultén's (1968) distribution maps.

Agropyron macrourum (Turcz.) Drobov	*Potentilla virgulata* Nels
Antennaria friesiana (Trauvt.) Ekman ssp. *friesiana*	*Potomogeton vaginatus* Turcz.
Antennaria monocephala DC. ssp. *angustata* (Greene)	*Primula stricta* Hornem.
Arabis arenicola (Richards.) Galert	*Puccinellia langeana* (Berl.) Sørens.
Calamagrostis deschampsioides Trin.	*Puccinellia vaginata* (Lange) Fern. and Weath.
Calamagrostis holmii Lange	*Ranunculus confervoides* (E. Fries) E. Fries
Campanula lasiocarpa Cham. ssp. *lasiocarpa*	*Ranunculus lapponicus* L.
Cardamine bellidifolia L.	*Ranunculus sulphureus* Soland
Cnidium cnidiifolium (Turcz.) Schischk.	*Rumex arcticus* Trautv.
Deschampsia brevifolia R. Br.	*Salix arctolitoralis* Hult.
Deschampsia pumila (Trin.) Ostenf.	*Salix fuscescens* Anderss
Draba caesia Adams	*Salix polaris* Wahlenb.
Draba fladnizensis Wulf.	*Saxifraga flagellaris* Willd
Draba nivalis Liljebl.	*Solidago multiradiata* Ait. var. *multiradiata*
Draba pseudopilosa Pohle	*Stellaria crassifolia* Ehrh.
Empetrum nigrum L. ssp. *hermaphroditum* (Lange) Bocher	*Stellaria longipes* Goldie
Hedysarum hedysaroides (L.) Schniz. and Thell.	*Stellaria monantha* Hult.
Kobresia simpliciuscula (Wahlenb.) Mack.	*Taraxacum alaskanum* Rydb.
Minuartia obtusiloba (Rydb.) House	*Tofieldia coccinea* Richards.
Poa arctica R. Br. ssp. *caespitans* (Simmons) Nannf.	*Tripleurospermum phaeocephalum* (Rupr.) Pobed.
Poa lanata Scribn. and Merr.	*Woodsia glabella* R. Br.

Table 45. Numbers of taxa reported at six northern Alaskan stations and one high arctic station.

	Number of taxa reported				
Station	*Vascular plants*	*Hepatics*	*Mosses*	*Lichens*	*Data source*
Prudhoe Bay region	238	25	115	83	
Fish Creek	158	27	79	40	Johnson et al. (1978)
Barrow	125	45	179	108	Murray and Murray (1978)
Atkasook	246	—	—	—	Komárková and Webber (1980)
Cape Thompson	305	14	85	78	Johnson et al. (1966)
Lake Peters region	278	—	—	—	Batten (1977)
Truelove Lowland, Devon Island	96	—	134	172	Vascular plants—Bliss (1977); Mosses—Vitt (1977); Lichens—Richardson (1977)

Table 46. List of vascular plant families in the Prudhoe Bay region.

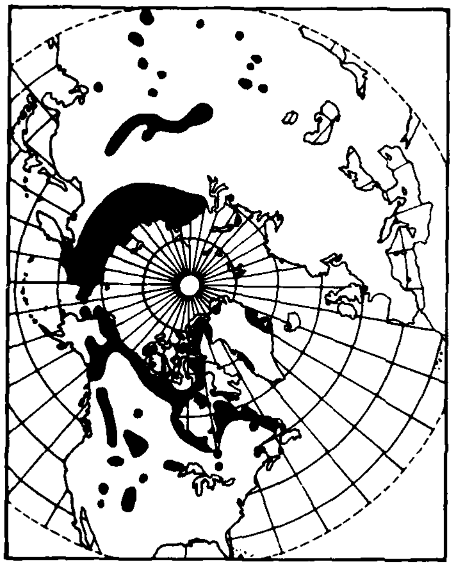
	Number of taxa	*Percent of vascular flora*
Lycopodiaceae	1	0.42
Equisetaceae	3	1.26
Sparganiaceae	1	0.42
Poaceae	31	13.03
Cyperaceae	29	12.18
Juncaceae	9	3.78
Liliaceae	2	0.84
Salicaceae	12	5.04
Polygonaceae	4	1.68
Caryophyllaceae	15	6.30
Ranunculaceae	11	4.62
Papaveraceae	2	0.84
Brassicaceae	21	8.82
Crassulaceae	1	0.42
Saxifragaceae	15	6.30
Rosaceae	8	3.36
Fabaceae	13	5.46
Onagraceae	2	0.84
Haloragaceae	2	0.84
Umbelliferae	1	0.42
Pyrolaceae	2	0.84
Ericaceae	5	2.10
Primulaceae	4	1.68
Plumbaginaceae	2	0.84
Gentianaceae	2	0.84
Polemoniaceae	3	1.26
Boraginaceae	2	0.84
Scrophulariaceae	10	4.20
Lentibulariaceae	1	0.42
Valerianaceae	1	0.42
Campanulaceae	1	0.42
Asteraceae	22	9.24
	238	99.97

Fish Creek and Atkasook are somewhat inland. Fish Creek is an abandoned drill site near the delta of the Colville River (Lawson et al. 1978). Atkasook is farther inland, about 100 km south of Barrow on the Meade River. The climate and landscape of Atkasook are similar to that near the Kuparuk airstrip. The Lake Peters region is a 304-km^2 area on the northern front of the Brooks Range at an elevation of 853 m. After Barrow and Cape Thompson it is the next best known site in northern Alaska. The large number of vascular plants there is due to the great variety of elevation and microhabitats found in the mountains. The Truelove Lowland is included in Table 45 to offer a comparison with a high arctic study area. The cryptogam floras of Barrow and Truelove Lowland have been the most thoroughly collected by experts, and the sizes of their floras reflect this. The lichens and bryoflora of the Prudhoe Bay region have not been studied intensively except for a small bryological study by Rastorfer et al. (1973). Most other collections have been made during brief forays by B. Murray, W.C. Steere, D.H. Richardson and others. Contributions from this study have been significant, although a bryologist or lichenologist examining the same areas would have found many more taxa.

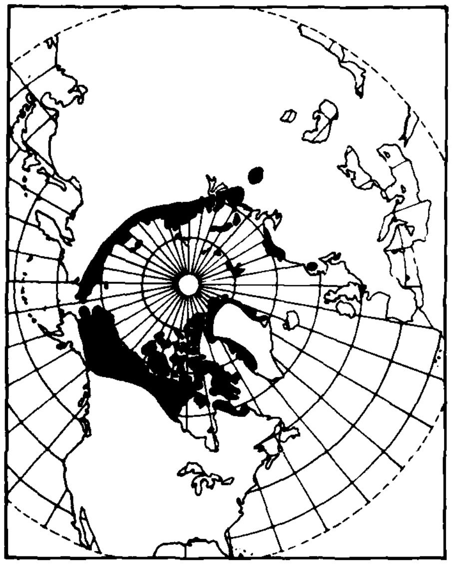
Table 46 is a breakdown of the Prudhoe Bay vascular flora by families. The high percentages for the families Poaceae, Cyperaceae, Brassicaceae, Caryophyllaceae and Saxifragaceae are typical for arctic regions.

Methods

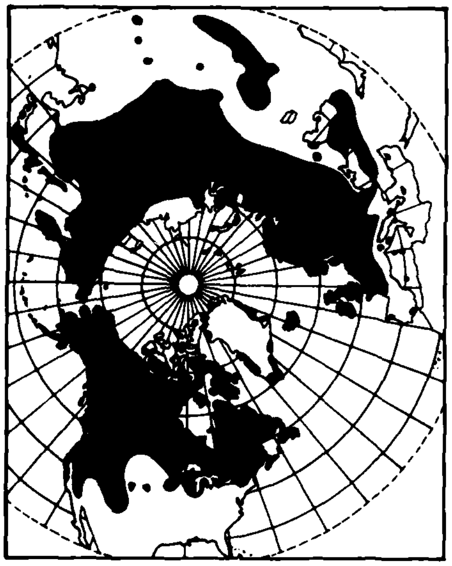
I used Hultén's (1958, 1962, 1968) distribution maps to group the Prudhoe Bay vascular plants into floristic units that were meaningful for the Prudhoe Bay region based on a similar analysis by Komárková (1976) in her treatment of the alpine flora of the Indian Peaks area in Colorado. Each plant taxon was classified according to 1) the principal environmental regions in which the plant is found, 2) the worldwide range of distribution of the plant, and 3) the plant's northernmost limit of distribution. Not all the plants fit cleanly into a single unit for each category. For this reason and due to a lack of more extensive knowledge about



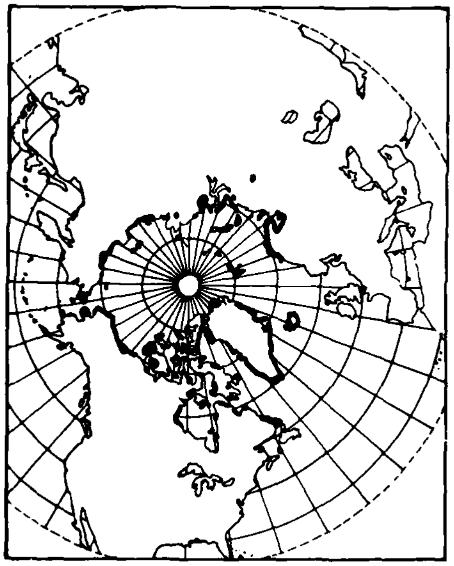
a. Ranunculus pedatifidus: *Arctic-alpine; Circumpolar; Zone 2.*



b. Luzula arctica: *Arctic; Circumpolar; Zone 1.*



c. Hippuris vulgaris: *Arctic-boreal; Circumpolar; Zone 2.*



d. Cochlearia officinalis: *Coastal; Circumpolar; Zone 1.*

Figure 59. Distributions of four plants representative of the four environmental floristic units. The designations following each plant name are environmental unit, geographic range, and northern limit. (Base map adapted from Hultén 1958.)

all the taxa, the classification was kept rather simple. The analysis is based on the 223 vascular taxa that were known from the area in 1980 (Appendix D).

Environment

Four environmental units were used: 1) arctic-alpine, 2) arctic, 3) arctic-boreal, and 4) coastal. The arctic-alpine plants are those that occur in arctic tundra regions but also extend into alpine tundra regions outside the Arctic. Often these plants have major distribution areas in the Rocky Mountain cordillera, the Asiatic ranges and the Alps. *Ranunculus pedatifidus* (Fig. 59) is an arctic-

alpine plant with a discontinuous distribution pattern. Others, such as *Silene acaulis, Carex saxatilis* and *Eriophorum angustifolium* ssp. *subarcticum* have more continuous patterns with major extensions into the southerly trending mountain ranges of North America and/or Asia. Other arctic-alpine plants include *Androsace chamaejasme* ssp. *lehmanniana, Carex aquatilis, Valeriana capitata, Arnica alpina, Draba alpina, Festuca baffinensis* and *Saxifraga oppositifolia*. This is the largest environmental category, with 108 taxa, or 48% of the vascular flora.

The arctic plants are those that are limited to arctic or near-arctic regions, including all of Alaska and regions in Canada and Asia within a few hundred kilometers of treeline. Within these regions the plants may occur in lowland tundra, forest or alpine settings. It would have been best to separate the alpine plants from the others, but this was difficult to do solely on the basis of Hultén's maps, the primary criteria for this analysis. An example of an arctic plant is *Luzula arctica* (Fig. 59). Other typical arctic taxa are *Alopecurus alpinus, Arctophila fulva, Carex membranacea* and *Eriophorum scheuchzeri*. This category contains 74 taxa, or 33% of the flora.

Arctic–boreal plants occur in arctic and cool temperate regions, primarily the extensive boreal forests of Canada and the USSR. *Hippuris vulgaris* (Fig. 59) is an example of an arctic–boreal plant. Others include *Equisetum arvense, Ledum palustre* ssp. *decumbens, Pyrola grandiflora, Rubus chamaemorus* and *Vaccinium vitis-idaea*. This relatively small group contains 25 taxa, about 11% of the flora.

Coastal plants are limited to the environment near the coast. *Cochlearia officinalis* (Fig. 59) is a coastal plant. Others include *Dupontia fisheri, Braya pilosa, Potentilla pulchella, Puccinellia andersonii* and *Salix ovalifolia*. This is the smallest physiographic unit, containing only 17 taxa, or 8% of the flora. All the coastal plants at Prudhoe Bay could also be considered arctic plants.

Geographic range

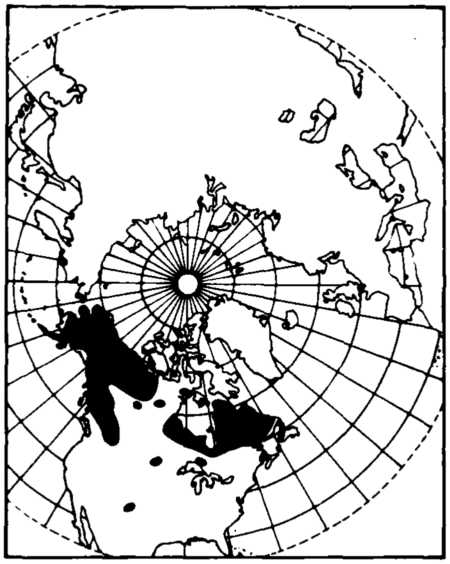
Six categories of geographic range were used in the analysis. The North America category contains those plants that have wide distributions on the North American continent but are nearly excluded from other continents. A few scattered occurrences in such areas as Chukotka or Greenland were permitted in this category. *Anemone parviflora* (Fig. 60) is a North American plant. Other examples are *Agropyron boreale* ssp. *hyperarcticum, Astragalus aboriginorum, Carex scirpoidea, Lupinus arcticus* and *Saxifraga tricuspidata*. This small unit includes 16 taxa, or about 7% of the flora.

The North America–Asia category includes plants that occur broadly in both North America and Asia. It also contains plants just reaching Alaska from the west. Beringian plants, such as *Oxytropis nigrescens* ssp. *bryophila* (Fig. 60), fit in this category. Some of these plants may extend as far west as eastern Europe but their large distribution gaps in western Europe and the amphi-Atlantic region, including Greenland and eastern North America, prevent them from being considered circumpolar. Examples include *Arctostaphylos rubra, Arnica frigida, Artemisia arctica, Castilleja caudata, Oxytropis arctica, Chrysanthemum bipinnatum* ssp. *bipinnatum, Lagotis glauca* ssp. *minor* and several taxa of *Salix*, including *S. alaxensis, S. ovalifolia* and *S. phlebophylla*. The unit contains 67 taxa, 30% of the flora.

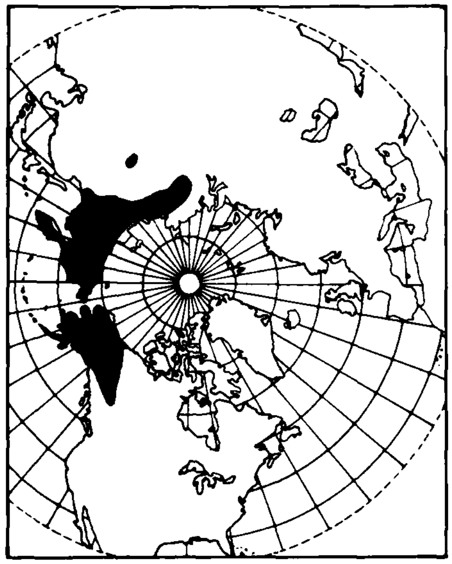
The eastern North America category includes plants with centers of distribution east of Alaska (Fig. 60). The category includes amphi-Atlantic plants and those taxa with major distribution gaps in eastern Asia. Only five plants fit in this category: *Salix arctophila, Silene acaulis, Mertensia maritima* ssp. *maritima, Pedicularis hirsuta* and *Puccenellia andersonii.*

The circumpolar category includes over 52% of the taxa at Prudhoe Bay, or 116 plants. These plants are found throughout the Arctic (Fig. 59), although there may be small gaps in part of the circumpolar region. *Ranunculus pedatifidus* (Fig. 59), for example, does not occur in Europe; it does, however, occur in Spitzbergen, Greenland, northern Canada, Alaska and Asia, so here it is considered circumpolar. Others, such as *Carex chordorrhiza*, have gaps in Greenland. The group also contains circumboreal plants that occur in the Arctic but are mainly found in forested regions. *Ranunculus trichophyllus* var. *eradicatus* is a good example.

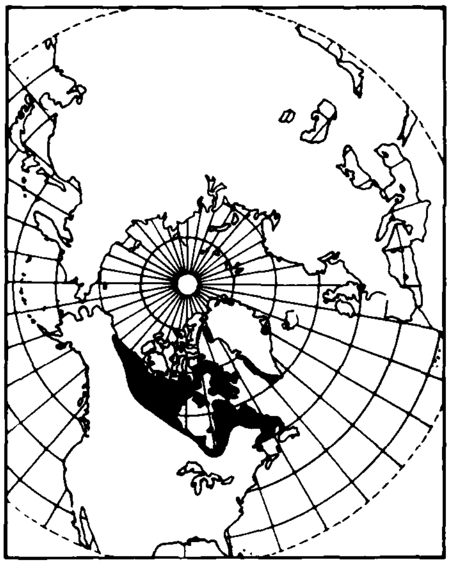
The northwest America unit contains plants that are essentially limited to the western part of North America. *Boykinia richardsonii* (Fig. 60), *Draba longipes, Pedicularis sudetica* ssp. *interior, Senecio hyperborealis* and *Thlaspi arcticum* are apparently limited to the North American side of Beringia. Others, such as *Dodecatheon frigidum, Salix rotundifolia* ssp. *rotundifolia* and *Saussurea angustifolia*, have their major centers of distribution in northwest America, but also have a few occurrences in eastern Asia. These three plants could



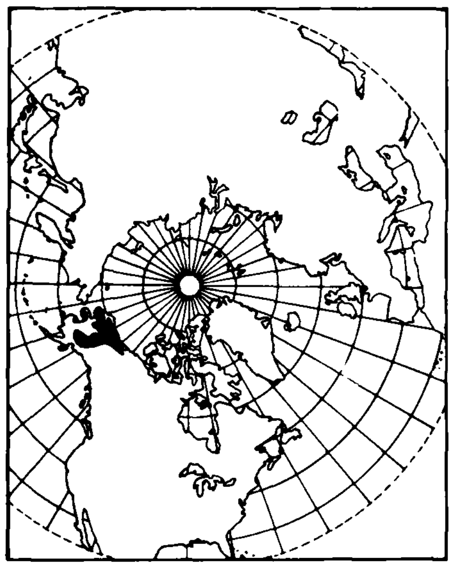
a. Anemone parviflora: *Arctic-alpine; North America; Zone 3.*



b. Oxytropis nigrescens *ssp.* bryophila: *Arctic-alpine; North America-Asia; Zone 2.*



c. Salix arctophila: *Arctic: Eastern North America; Zone 2.*

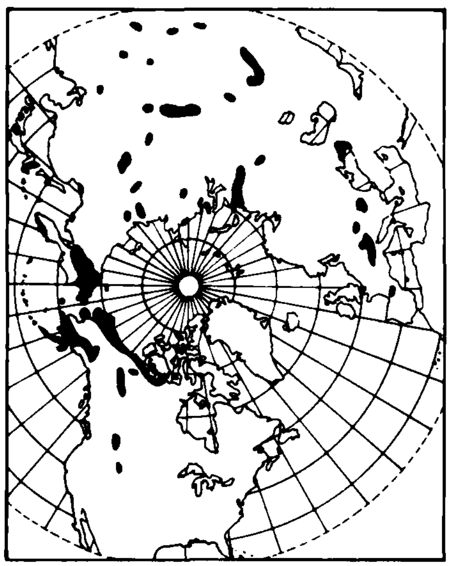


d. Boykinia richardsonii: *Arctic; Northwest America; Zone 3.*

Figure 60. Examples of five of the six geographic range floristic units. The Circumpolar unit is represented by all the examples in Figure 59. (Base map adapted from Hultén 1958.)

have been classified as North American-Asian. They were placed here because their distributions are centered in North America. The group contains 12 taxa, about 5% of the vascular flora.

The final unit of geographic range is the western North America-Asia-Europe unit. This is a somewhat arbitrary unit that contains taxa that occur farther west (i.e. towards Europe from Asia) than in the North America-Asia unit. Some of the taxa, such as *Androsace chamaejasme* ssp. *lehmanniana* (Fig. 60), *Pedicularis verticillata, Gentiana prostrata* and *Lloydia serotina,* are arctic-alpine



e. Androsace chamaejasme: *Arctic-alpine; North America-Asia-Europe; Zone 2.*

Figure 60 (cont'd).

plants that are scattered throughout the Alps, the Rocky Mountains, and the Asian ranges. Others, such as *Caltha palustris* ssp. *arctica, Petasites frigidus* and *Polemonium acutiflorum,* occur throughout northern Asia, western North America and much of Europe but have large gaps in Greenland and eastern North America. This is a small group with only 7 taxa, 3% of the vascular flora.

Northern limit

Probably the most meaningful divisions for analyzing the northern limit of plants are those of Young (1971). In his analysis of the flora of St. Lawrence Island, he noted that temperature is so important that the size of the flora for a given arctic location can often be predicted, within limits, solely on the basis of summer temperatures. The importance of summer temperature to arctic vegetation has been thoroughly discussed in numerous studies (e.g Sǿrenson 1941, Clebsch 1957, Böcher 1959, Cantlon 1961, Clebsch and Shanks 1968), and Young has divided the Arctic into floristic zones on the basis of temperature alone.

Young's four zones are shown in Figure 61. Zone 1 is the coldest and contains only the extreme polar deserts; Zone 4 is the warmest and corresponds to low arctic regions. He defined the zones on the basis of a summer warmth index a, which is the sum of the mean monthly temperatures above 0°C. For example, if the mean monthly temperatures for May, June, July, August and September were -4, 3, 8, 7 and -2°C, respectively, then the value of a would be 18. Zone 1 has a summer warmth index between 0 and 6; for Zone 2, $6 \leq a < 12$; for Zone 3, $12 \leq a < 20$; and for Zone 4, $20 \leq a < 35$. Zone 1 areas normally have less than 50 taxa in their floras; Zone 2 areas typically have 75–125 taxa; Zone 3 areas have up to 250 taxa; and Zone 4 areas may have as many as 500 taxa.

There are three of Young's floristic zones in the Prudhoe Bay region (Table 47). The area immediately adjacent to the coast, represented by West Dock, had a summer warmth index of 8.4 in 1977, which places this area in Zone 2. The average index for this site for several years would probably be less, since 1977 was an abnormally warm year on the North Slope. Inland sites, represented by Drill Site 2, Pad F, Arco and Deadhorse, have warmth indices between 12 and 29. Arco, Drill Site 2 and Pad F are clearly in Zone 3. Deadhorse would be in Zone 4 on the basis of the 1977 temperatures, but that was an abnormal year. The number of taxa currently known from just south of Deadhorse suggests this area is actually in Zone 3. However, the number of taxa increases very rapidly toward the south, so the boundary of Zone 4 is not far south of Deadhorse.

Each taxon in the Prudhoe Bay flora was placed in a single zone using Young's (1971) judgements whenever possible. For plants that do not also occur on St. Lawrence Island, Hultén's (1968) maps were used. Some of these are probably outdated, but the northern limits for the great majority of taxa are at least close to those shown by Hultén. In a few cases a taxon did not conform to Young's boundaries throughout the Arctic. For example, a species may follow the northern edge of Zone 3 throughout most of its range, yet it may have an isolated occurrence in Zone 1, possibly due to genetic differences within the currently defined taxon. In these instances the northern limit of the taxon in the areas closest to Alaska was used. The floristic classifications for the 223 vascular plants used in this analysis are in Appendix D.

To examine the changes in the regional flora with respect to the coastal temperature gradient, the region was divided into temperature areas based on the 1977 mean July isotherms (Fig. 62). Although 1977 was warmer than normal, it is the only year for which there are good data for all the stations near the coast. The 4°C isotherm is the

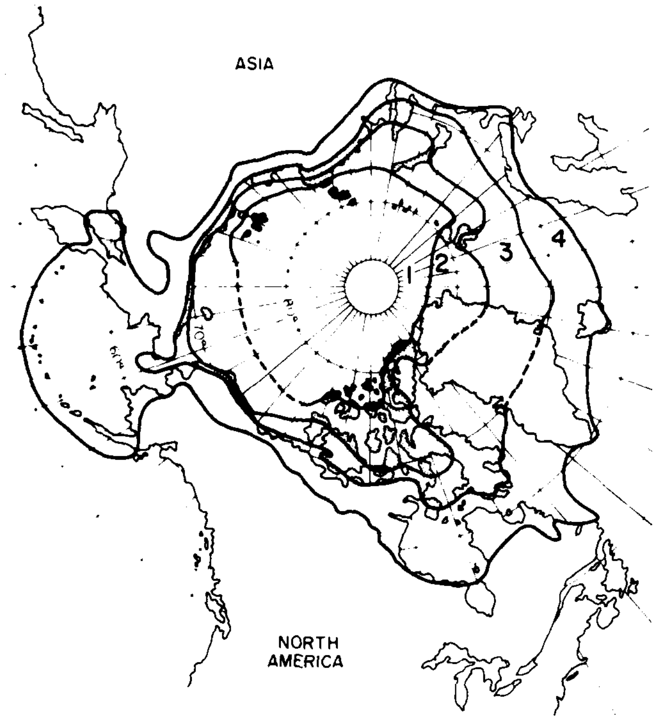


Figure 61. Floristic zones for analyzing the northern limits of plant distribution. (Adapted from Young 1971.)

Table 47. Summary of summer temperature data for several stations along the Sagavanirktok River, Alaska. The summer warmth index a is the sum of all mean monthly temperatures above 0°C. The thaw degree-day (TDD) accumulation is the sum of all daily mean temperatures above 0°C. The floristic zones are determined by Young's (1971) criteria: Zone 1, $0 \le a < 6$; Zone 2, $6 \le a < 12$; Zone 3, $12 \le a < 20$; Zone 4, $20 \le a < 35$. The starred (*) stations are the willow collection locations.

	Distance to coast (km)			Temperature (°C)				Summer		
Station	Shortest	In wind direction	Year	J	J	A	S	warmth index	TDD	Floristic zone
West Dock	0.7	0.7	1976	—	4.1	4.2	0.3	—	—	
			1977	-1.5	2.6	4.2	1.6	8.4	318	2
*Drill Site 9	4.0	18.0								
Drill Site 2	4.6	20.1	1977	0.1	4.2	7.1	2.2	12.2	438	3
Pad F	7.1	11.3	1976	—	5.4	4.1	1.1	—	—	3
			1977	4.0	4.2	6.2	1.7	16.1	491	
ARCO	6.0	21.0	1976	3.2	6.8	6.6	1.7	18.3	571	3
			1977	3.7	5.5	8.2	2.5	19.9	643	
			8-yr mean	3.0	6.7	6.0	0.2	16.0	526	
*Deadhorse	12.0	26.0	1976	4.3	7.3	5.8	—	—	—	3
			1977	5.7	7.6	9.8	5.8	28.9	—	
*Mile 350	25.0	43.0								
*Pipeline Intersection	37.0	62.0								
*Franklin Bluffs	70.0	125.0	1976	3.2	9.8	9.4	2.7	25.1	793	4
			1977	5.7	7.5	12.1	3.2	28.5	884	
*Pump 2 (Coastal Plain)	98.0	235.0								
*Pump 2 (Foothills)	100.0	235.0								
Sagwon Upland	102.0	240.0	1976	5.0	10.8	10.0	2.7	29.0	913	4
			1977	6.5	10.0	12.9	3.3	32.7	1040	

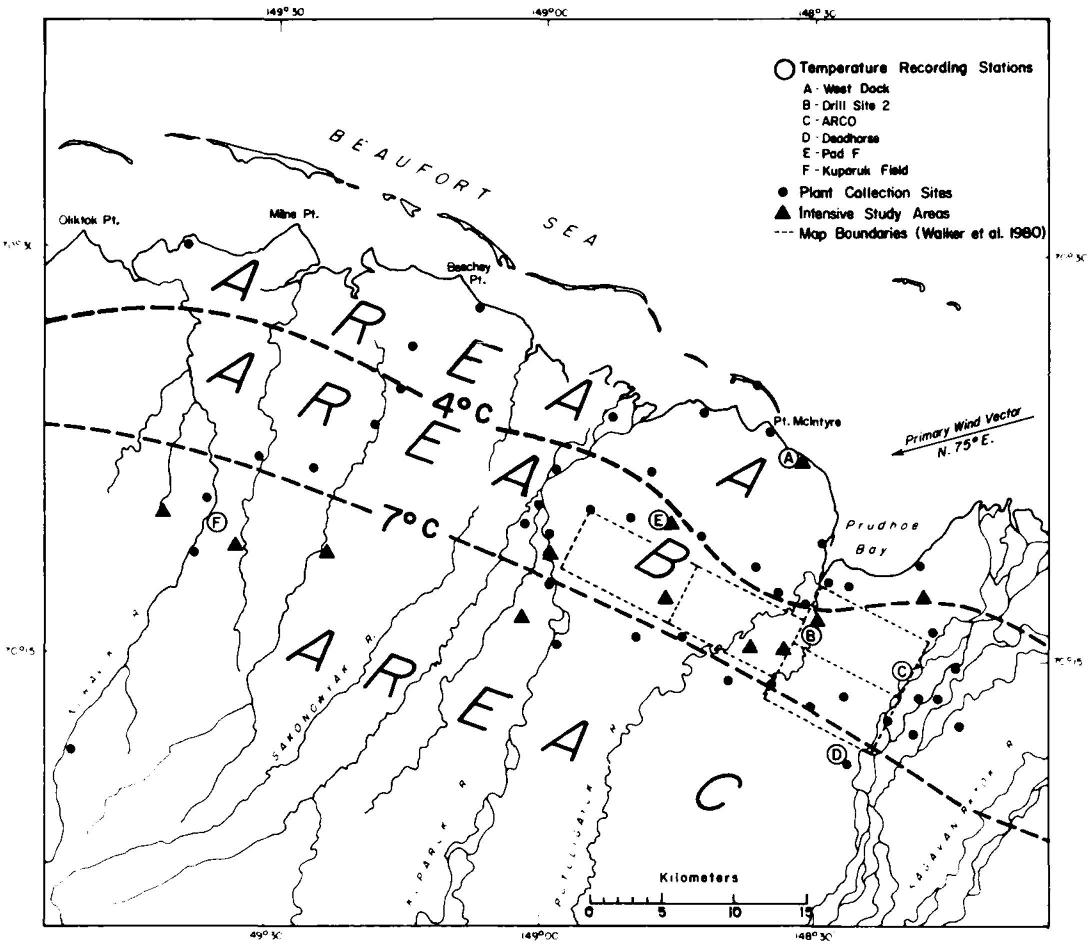


Figure 62. Temperature zones within the Prudhoe Bay region. Boundaries are based on 1977 data at stations A through E and on the distance to the coast measured in the direction of the primary summer winds.

boundary between Area A and Area B, and the 7 °C isotherm is the boundary between Areas B and C. The 7 °C isotherm was used because it corresponds to the boundary between Cantlon's littoral and typical tundras, and because the July mean temperature at Deadhorse is near this value. The lines for the isotherms were based on temperatures at five stations: West Dock, Drill Site 2, Pad F, ARCO and Deadhorse. Temperatures near the coast have been shown to be highly correlated to distance to the coast measured in the direction of the primary summer wind vector, N75 °E (Walker and Webber 1979a, Haugen and Brown 1980). This information was used for determining the position of the 4 °C isotherm. Note that the area covered by the maps in the geobotanical atlas of the region (Walker et al. 1980) lies almost entirely within Area B. The occurrence of each taxon in the temperature areas was determined on the basis of plant lists and observations at the locations shown in Figure 62.

Results and discussion

The distribution of the various floristic units with respect to the total vascular flora and the changes along the moisture gradient are shown in Table 48 and Figure 63. The flora consists mainly of arctic-alpine and arctic taxa, with 81% of the plants accounted for by these two categories. The arctic-boreal and coastal proportions are relatively small. More than half of the plants have circumpolar distributions. The northern limits of most of the plants are in Zone 2 or Zone 3.

Analysis of the flora along the moisture gradient.

The dry sites within the Prudhoe Bay region have the highest percentages of arctic-alpine

Table 48. Distribution of floristic units for the total vascular Prudhoe Bay flora and for taxa in each moisture category.

	Total flora (223 taxa)	Number of taxa (Percentage of taxa) Dry sites (143 taxa)	Moist sites (123 taxa)	Wet sites (68 taxa)	Aquatic sites (14 taxa)
Environment					
Arctic-alpine	107 (48.0)	76 (53.2)	62 (50.4)	32 (47.1)	3 (21.4)
Arctic	74 (33.2)	50 (35.0)	41 (33.3)	21 (30.9)	5 (35.7)
Arctic-boreal	25 (11.2)	6 (4.2)	13 (10.6)	7 (10.3)	5 (35.7)
Coastal	17 (7.6)	11 (7.7)	7 (5.7)	8 (11.8)	1 (7.1)
Geographic Range					
North America	16 (7.2)	14 (9.8)	6 (4.9)	4 (5.9)	1 (7.1)
North America-Asia	67 (30.0)	49 (34.3)	34 (27.6)	15 (22.1)	1 (7.1)
East North America	5 (2.2)	3 (2.1)	4 (3.2)	0 (0.0)	0 (0.0)
Circumpolar	116 (52.0)	61 (42.7)	70 (56.9)	47 (69.1)	11 (78.6)
Northwest America	12 (5.4)	11 (7.7)	5 (4.1)	2 (2.9)	0 (0.0)
West North America-Asia-Europe	7 (3.1)	5 (3.5)	4 (3.2)	0 (0.0)	1 (7.1)
Northern Limit					
Zone 1	31 (13.9)	22 (15.4)	24 (19.5)	13 (19.1)	0 (0.0)
Zone 2	89 (39.9)	59 (41.3)	54 (43.9)	31 (45.6)	6 (42.9)
Zone 3	85 (38.1)	57 (39.9)	39 (31.7)	16 (23.5)	4 (28.6)
Zone 4	18 (8.1)	5 (3.5)	6 (4.9)	8 (11.8)	4 (28.6)

plants and North American-Asian plants. The proportion of arctic-alpine taxa (48%) is enhanced by the proximity of the Brooks Range. Murray (1978) noted that most rivers east of and including the Kuparuk River have their headwaters in the Brooks Range; many taxa normally associated with alpine areas, such as *Saxifraga tricuspidata, Phlox sibirica, Gentiana prostrata* and *Potentilla biflora,* have probably used the river systems as corridors for dispersal from the mountains to suitable habitats on the coastal plain. Within the Prudhoe Bay region there are many pingos, which act as dry, alpine-like islands in a sea of wet tundra. Other dry sites include river terraces, sand dunes and high-centered polygons.

Young (1975) emphasized the importance of mountain ranges in the development of the Beringian flora. He maintained that species preadapted in the severe alpine climates of Asia and North America were able to spread to low-lying areas when glaciers retreated and/or the climate became suitable. The climate of the coastal plain has probably oscillated radically in conjunction with marine regressions and transgressions and the generally dry climate of the region during the last glaciation. The presence of many small, dry refugia, such as pingos, has undoubtedly helped speed the rate at which the vegetation adjusted to changes in climate. Johnson and Packer (1967) speculated that it may be the lack of refugia on the submerged portions of the Beringian shelf that prevented the interchange of many alpine plants that are now found on only one or the other side of the Bering Strait.

There is also a general increase in the percentage of Asian taxa toward the dry end of the gradient, with 34% in the dry types, 28% in the moist types, 22% in the wet types, and only 7% in the emergent types. The vegetation types with the highest percentages of North American-Asian plants are Types B4, B11 and B13, with 45%, 39% and 38%, respectively. Type B4 occurs on river bars, Type B11 occurs on dry coastal bluffs, and Type B13 occurs on stabilized sand dunes. None of the moist or wet vegetation types have more than 33% North American-Asian taxa.

The presence of so many Asian plants is a result of the geologically recent connection between North America and Asia. During major glacial intervals the sea level was lowered, exposing the floor of the Chukchi Sea and permitting the fauna and flora to cross. Most of the movement of plants and animals was from the west to the east, since the eastern routes of migration were blocked by the Laurentian and Cordilleran ice sheets. This is reflected in the low number of plants, only 2%, that have their centers of distribution to the east of Prudhoe Bay.

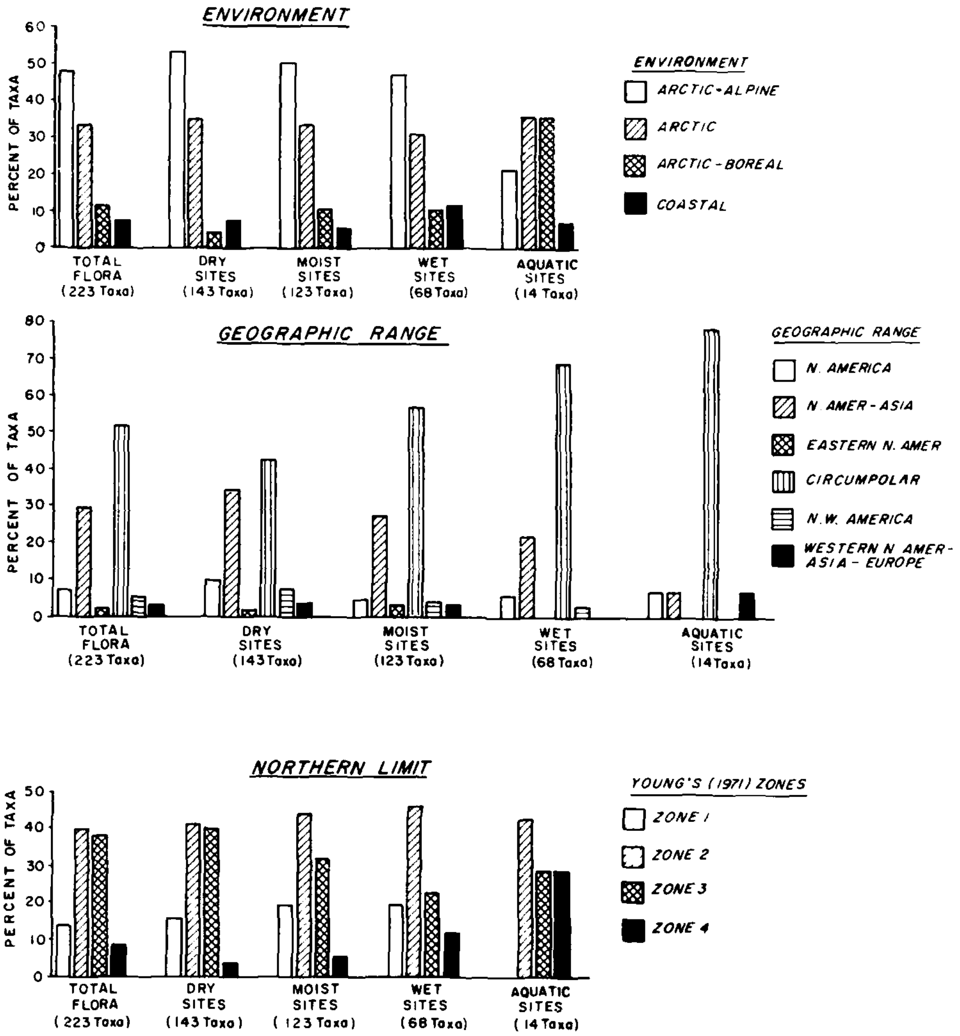


Figure 63. Floristic analysis of the Prudhoe Bay region's vascular flora based on data available in 1980. The percentages of plant taxa in the various floristic elements are portrayed for the entire flora and for the flora in each of the major site moisture categories.

We might expect to see a higher percentage of Zone 1 plants in the dry sites since these areas are often very exposed and seem to be similar to the polar deserts of the high arctic. However, there is actually a lower percentage of Zone 1 plants in the dry sites than in either the moist or wet sites (Table 48). There are about equal percentages of Zone 2 and 3 plants in all moisture categories, and there is a general increase in the percentage of Zone 4 plants with increasing site moisture. There are virtually no boreal or Zone 4 plants in the coldest areas along the coast.

A closer look at the data from dry sites reveals a possible explanation for the apparent anomaly of Zone 1 taxa in dry sites (Table 49). The highest percentages of Zone 1 plants occur in Types B2, B3, B12 and B15, all with over 30% Zone 1 plants. Type B2 occurs on high-centered polygons, B3 on frost boils, B12 on coastal high-centered polygons, and B15 on frost-active polygon rims near the coast. These types all have high values for cryoturbation (Table 50). Cryoturbation was rated on a four-point scale, and all of these types have mean values of at least three. Types B1 and B6 also have high values for cryoturbation, but they are due mainly to the presence of large hummocks and solifluction rather than to the deep frost stirring that occurs in the other vegetation types.

Raup (1968) has shown that one of the main selective advantages of high arctic plants is their ability to withstand wide variations in moisture, cover and frost-disturbance gradients. Many of

Table 49. Floristic analysis for the dry (B) vegetation types.

	Number of taxa (Percentage of taxa)													
	B1	*B2*	*B3*	*B4*	*B5*	*B6*	*B8*	*B9*	*B10*	*B11*	*B12*	*B13*	*B14*	*B15*
	25 taxa	*34 taxa*	*22 taxa*	*65 taxa*	*16 taxa*	*28 taxa*	*4 taxa*	*2 taxa*	*2 taxa*	*18 taxa*	*11 taxa*	*24 taxa*	*7 taxa*	*12 taxa*
Environment														
Arctic-alpine	16(64.0)	20(58.8)	14(63.6)	36(55.4)	13(81.2)	19(67.9)	0 (0.0)	1(50.0)	0 (50.0)	12(66.7)	6(55.6)	19(79.2)	4(57.1)	8(66.7)
Arctic	8(32.0)	13(38.2)	7(31.8)	25(38.5)	2(12.5)	8(28.6)	0 (0.0)	1(50.0)	1 (0.0)	2(11.1)	5(45.4)	3(12.5)	3(42.9)	4(33.3)
Arctic-boreal	1 (4.0)	0 (0.0)	1 (4.6)	3 (4.6)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0(0.0)	0 (0.0)	1 (4.2)	0 (0.0)	0 (0.0)
Coastal	0 (0.0)	1 (2.9)	0 (0.0)	1 (1.5)	1 (6.2)	0 (0.0)	4(100.0)	0 (0.0)	1 (50.0)	4(22.2)	0 (0.0)	1 (4.2)	0 (0.0)	0 (0.0)
Geographic range														
North America	3(12.0)	3 (8.8)	2 (9.1)	7(10.8)	3(18.8)	4(14.3)	0 (0.0)	0 (0.0)	0 (0.0)	1 (5.6)	0 (0.0)	3(12.5)	1(14.3)	1 (8.3)
North America-Asia	8(32.0)	10(29.4)	7(31.8)	29(44.6)	3(18.8)	9(32.1)	0 (0.0)	1(50.0)	0 (0.0)	7(38.9)	3(27.3)	9(37.5)	2(28.6)	3(25.0)
East North America	0 (0.0)	1 (2.9)	1 (4.6)	2 (3.1)	0 (0.0)	1 (3.6)	1 (25.0)	0 (0.0)	1 (50.0)	1 (5.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Circumpolar	11(44.0)	18(52.9)	12(54.6)	21(32.3)	9(56.2)	10(35.7)	3 (75.0)	1(50.0)	1 (50.0)	7(38.9)	7(63.6)	11(45.8)	4(57.1)	7(58.3)
Northwest America	2 (8.0)	2 (5.9)	0 (0.0)	4 (6.2)	0 (0.0)	2 (7.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (9.1)	0 (0.0)	0 (0.0)	1 (8.3)
West North America-Asia-Europe	1 (4.0)	0 (0.0)	0 (0.0)	2 (3.1)	1 (6.2)	2 (7.1)	0 (0.0)	0 (0.0)	0 (0.0)	2(11.2)	0 (0.0)	1 (4.2)	0 (0.0)	0 (0.0)
Northern Limit														
Zone 1	4(16.0)	13(38.2)	7(31.8)	4 (6.2)	4(25.0)	4(14.3)	0 (0.0)	0 (0.0)	0 (0.0)	5(27.8)	5(45.4)	5(20.8)	1(14.3)	4(33.3)
Zone 2	15(60.0)	16(47.1)	11(50.0)	27(41.5)	8(50.0)	14(50.0)	4(100.0)	1(50.0)	2(100.0)	10(55.6)	5(45.4)	14(58.3)	5(71.4)	6(50.0)
Zone 3	6(24.0)	4(14.7)	4(18.2)	32(49.2)	4(25.0)	9(32.1)	0 (0.0)	1(50.0)	0 (0.0)	3(16.7)	1 (9.1)	5(20.8)	1(14.3)	2(16.7)
Zone 4	0 (0.0)	0 (0.0)	0 (0.0)	2 (3.1)	0 (0.0)	1 (3.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

the most common plants in the Mesters Vig district of Greenland are those that can tolerate a great deal of disturbance to their root systems. The most exposed sites at Prudhoe Bay are the Type B1 areas, but these sites are usually quite gravelly and stable. The percentage of Zone 1 plants in these sites is not as high as in the highly frost-active areas, suggesting that frost stirring is indeed a major site factor selecting for Zone 1 taxa in dry areas, and that extreme exposure is less important.

Beaufort Sea influence and the temperature gradient

One of the strongest controls on the flora of the region is the Beaufort Sea. Its influence is twofold. First, about 8% of the flora is distinctly coastal; these taxa are rarely found far from the ocean. Within the region there is a distinct reduction of coastal taxa away from the coast. Of the 17 taxa classed as coastal, only *Dupontia fisheri, Salix ovalifolia* ssp. *ovalifolia, Carex marina,* and *Draba borealis* are commonly found more than a kilometer inland. The compressed temperature gradient also has a major effect on the regional flora. The diversity of the flora increases markedly with distance from the coast. With respect to the temperature areas, there are a total of 115 taxa in Area A, 165 in Area B, and 188 in Area C.

The floristic changes associated with increasing temperature and distance from the coast are portrayed in Figure 64. There is a general increase in

Table 50. Mean values for cryoturbation in the dry vegetation types. A 4-point subjective scale is used: 1—low, no surficial evidence of cryoturbation; 2—some evidence on less than 5% of the surface; 3—much evidence on 5-30% of the surface; 4—considerable evidence on more than 30% of the surface.

Vegetation type	*Cryoturbation*	*Vegetation type*	*Cryoturbation*	*Vegetation type*	*Cryoturbation*
B1	2.8	B6	3.0	B12	3.0
B2	3.0	B8	1.0	B13	1.3
B3	4.0	B9	1.0	B14	2.0
B4	1.0	B10	1.0	B15	3.0
B5	2.0	B11	2.0	Overall mean: 1.7	

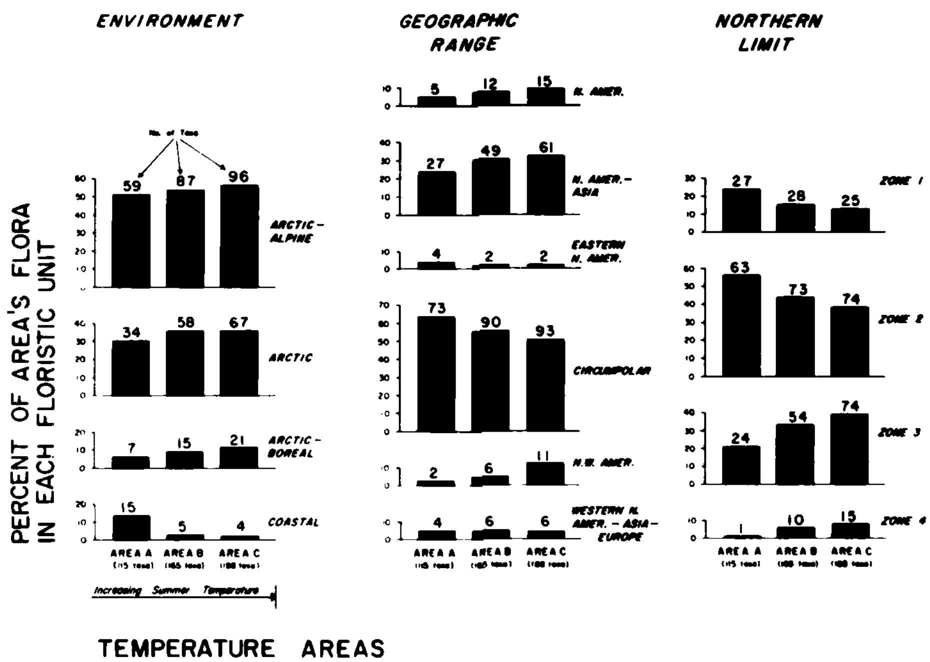


Figure 64. Floristic analysis of the three temperature areas in Figure 62.

the percentages of arctic-alpine, arctic-boreal and arctic plants.

There is an increase in the North America, North America-Asia, and northwest America categories. The percentage of circumpolar taxa decreases, even though the number of circumpolar taxa increases.

If we consider high arctic plants to be those with northern limits either in Young's Zones 1 or 2, then 88% of the taxa in Area A are high arctic. In contrast, Area B has 61% high arctic taxa and Area C has 53%. The percentage of high arctic plants is smaller not because of a decline in the number of high arctic taxa, but because of a dramatic increase in the number of low arctic taxa. The number of Zone 3 plants increases from 24 to 74, and the number of Zone 4 plants increases from 1 to 15.

The northern coast of Alaska and westernmost Canada is one of two areas in the Arctic where the boundaries for three of Young's zones converge within a short distance of the coast (Fig. 61). The other is near the Kolyma River in Siberia. Even though most of the Prudhoe Bay region is in Young's Zone 3, it is not surprising to find several Zone 4 plants here because of the compressed zonation. There are 18 Zone 4 plants, but none of these are abundant in the region, and most occur only in the southern portion of the region.

The region experiences fairly dramatic year-to-year variations in the amount of summer warmth that is available for plant growth. Since the mean summer temperatures are so near freezing, a slightly warmer summer can result in a large difference in the total number of annual thaw degree-days and the magnitude of the summer warmth index.

Myers and Pitelka (1979) proposed that the effects of yearly variations in temperature along the arctic coast may, in fact, be as important as the temperature itself. They noted that temperature fluctuations near the freezing point are far more critical to organisms than fluctuations of comparable magnitude at different temperatures. Many plants and animals in the coastal ecosystems have evolved phenological mechanisms to deal with these variations. For example, most plants begin senescing early in August, before the air temperatures seem to require it (Tieszen 1972). Myers and Pitelka viewed this as a possible mechanism to ensure that the photosynthetic gains made during the summer are transferred to belowground biomass well before the onset of even the earliest winter. Near the arctic coast the yearly variations are critical because the temperatures are so close to freezing. The plants must be adapted to complete their growth cycles within the shortest, coldest growing seasons. A paleoecological implication of this is that relatively small changes in the position of the arctic coast should affect the vegetation. Since the temperature zonation is so compressed in northern Alaska, a shift in the coastline of a few kilometers caused by a marine regression or transgression should be accompanied by a corresponding shift of many of the taxa that cannot tolerate the cold coastal environment.

Since there are so many taxa that have temperature limitations near the coast (Tables 51-53), it should be possible to find a suite of temperature-sensitive tundra plants that can be detected in the palynological record. This tool would aid in interpreting climatic fluctuations that have occurred wholly within arctic tundra regions beyond the northern limit of birch, which has historically been used to detect shifts between a more severe graminoid-dominated tundra and a less severe shrub-dominated tundra (Livingstone 1955, Colinvaux 1967).

Floristic analysis of the most common taxa

Area analysis for the master maps of the region (Table 5) and cover data for the various vegetation types (Appendix C) were used to determine the dominant taxa in the Prudhoe Bay landscape. The column headings in Table 54 represent the vegetation types that cover at least 0.1% of the mapped area. The taxa listed are those that have at least 1% cover in any one of these vegetation types. Multiplying the average cover of a taxon within a vegetation type by the cover of the vegetation type within the region yields a value that represents the total cover of the plant within that type. Summing the values for all the vegetation types yields the total cover of the plant taxon within the mapped areas.

Very few plants have high percentages of cover. In fact, the top two plants, *Carex aquatilis* and *Dryas integrifolia,* account for about 64% of the vascular plant cover. These two, plus *Eriophorum angustifolium* ssp. *subarcticum* and *E. triste*, represent about 78% of the cover; the top 15 taxa account for 92% of the cover.

The top four taxa all have their northern limits in either Zone 1 or Zone 2 (Table 55). This accounts for the decidedly high arctic character of the region. However, of the taxa that cover more than 0.5% of the region (9 taxa), only about 56% are high arctic. The percentage remains about the same if we include all taxa with greater than 0.1%

Table 51. Taxa limited to the coastal area (Area A) and that have high arctic distributions (Young's Zones 1 or 2).

Braya pilosa	*Mertensia maritima* ssp. *maritima*
Carex subspathacea	*Phippsia algida*
Carex ursina	*Potentilla pulchella*
Cochlearia officinalis ssp. *arctica*	*Primula borealis*
Colpodium vahlianum	*Puccinellia phryganodes*
Honckenya peploides ssp. *peploides*	*Stellaria humifusa*

Table 52. Taxa recorded only in Areas B and C and that have low arctic distributions (Young's Zones 3 or 4).

Anemone richardsonii	*Gentiana prostrata*
Antennaria friesiana ssp. *alaskana*	*Gentianella propinqua* ssp. *propinqua*
Arabis lyrata ssp. *kamchatica*	*Hippurus vulgaris*
Arctostaphylos rubra	*Juncus arcticus* ssp. *alaskanus*
Arnica frigida	*Juncus triglumis* ssp. *albescens*
Aster sibiricus	*Kobresia sibirica*
Astragalus aboriginorum	*Lagotis glauca* ssp. *minor*
Boykinia richardsonii	*Orthilia secundata* ssp. *obtusata*
Bromus pumpellianus var. *arcticus*	*Oxytropis borealis*
Carex chordorrhiza	*Oxytropis deflexa* var. *foliolosa*
Carex rotundata	*Oxytropis maydelliana*
Carex vaginata	*Parnassia kotzebuei*
Chrysanthemum bipinnatum ssp. *bipinnatum*	*Poa glauca*
Descurainia sophioides	*Potentilla hookeriana* ssp. *hookeriana*
Dodecatheon frigidum	*Pyrola grandiflora*
Draba cinerea	*Ranunculus trichophyllus* ssp. *eradicatus*
Draba glabella	*Saussurea angustifolia*
Epilobium davuricum var. *arcticum*	*Senecio resedifolius*
Equisetum scirpoides	*Thalictrum alpinum*
Erigeron humilis	*Thlaspi arcticum*
Eriophorum callitrix	*Utricularia vulgaris* ssp. *macrorhiza*
Festuca rubra	*Wilhelmsia physodes*

Table 53. Taxa recorded only in Area C and that have low arctic distributions (Young's Zones 3 or 4).

Arctagrostis latifolia var. *arundinacea*	*Lupinus arcticus*
Artemisia tilesii ssp. *tilesii*	*Luzula multiflora*
Bupleurum triradiatum	*Oxytropis campestris* ssp. *gracilis*
Calamagrostis neglecta	*Oxytropis campestris* ssp. *jordalii*
Carex krausei	*Parrya nudicaulis* ssp. *septentrionalis*
Castilleja caudata	*Pedicularis verticillata*
Cerastium beeringianum var. *grandiflorum*	*Poa pratensis*
Draba borealis	*Potentilla palustris*
Erigeron hyperboreus	*Rubus chamaemorus*
Festuca ovina ssp. *alaskensis*	*Salix brachycarpa* ssp. *niphoclada*
Hedysarum alpinum ssp. *americanum*	*Salix glauca*
Juncus castaneus ssp. *castaneus*	*Senecio hyperborealis*
Juncus castaneus ssp. *leucochlamys*	*Sparganium hyperboreum*
Ledum palustre ssp. *decumbens*	*Tofieldia pusilla*
	Vaccinium uliginosum ssp. *microphyllum*

Table 54. Percent coverage of the most common taxa in the mapped area at Prudhoe Bay (Walker et al. 1980). **Taxa listed are those that cover more than 1% in vegetation types that cover more than 0.1% of the Prudhoe Bay region.**

	C = (percent cover of taxon) × (percent area of vegetation types)														Total cover within the Prudhoe Bay region
Vegetation type	*B1*	*B2*	*B3*	*B5*	*U2*	*U3*	*U4*	*M1*	*M2*	*M3*	*M4*	*M5*	*E1*	*E3*	
Percent of area mapped	0.28	0.31	0.91	0.12	1.39	10.89	6.32	4.64	24.54	0.58	12.92	0.34	0.75	2.53	*(ΣC × 100%)*
Carex rupestris	0.00009		0.00009												0.018
Dryas integrifolia	0.00134	0.00159	0.00164	0.00046	0.00286	0.03514	0.01220								5.523
Oxytropis nigrescens	0.00007														0.007
Saxifraga oppositifolia	0.00009	0.00015	0.00073												0.097
*Eriophorum angustifolium**	0.0000005	0.000003	0.00048		0.00120	0.01462	0.01036	0.00181	0.01548		0.00310	0.00017	0.00072		4.795
Carex misandra		0.00004						0.00104							0.108
Salix reticulata		0.00012				0.00184	0.00401					0.00020			0.617
Salix rotundifolia		0.00009													0.023
Saussurea angustifolia		0.00006													0.006
Pedicularis lanata			0.00009												0.009
Artemisia borealis				0.00003											0.003
Kobresia myosuroides				0.00002											0.002
Polygonum viviparum				0.00002											0.002
Carex bigelowii					0.00140	0.00725									0.865
Carex membranacea					0.00065	0.00821									0.886
Cassiope tetragona					0.00036										0.036
Eriophorum vaginatum					0.00132										0.132
Carex rotundata						0.00316									0.316
Salix arctica						0.00143	0.00262					0.00008			0.413
Dupontia fisheri						0.00002	0.00002		0.00058	0.00023		0.00004			0.089
Carex aquatilis							0.01543	0.00561	0.08191	0.00257	0.05239	0.00164	0.00185	0.00042	16.182
Salix lanata							0.00123								0.123
Carex rariflora								0.00686							0.686
Salix ovalifolia									0.00292	0.00006		0.00011			0.309
Equisetum variegatum										0.00037					0.037
Eriophorum scheuchzeri													0.00013		0.013
Arctophila fulva														0.00628	0.628
Other taxa	*0.00008*	*0.00018*	*0.00018*	*0.00003*	*0.00033*	*0.00375*	*0.00244*	*0.00176*	*0.01151*	*0.00002*	*0.00216*	*0.00010*	0.00004	0.00001	2.259
										Total percentage cover by all vascular plants					34.184

Percent of mapped area covered by dominant plants:

Percent of region covered (P_r):	Percent of total vascular plant cover = P_r/34.18
Top 2 taxa 16.182 + 5.523 = 21.705%	63.5%
Top 4 taxa 21.705 + 2.667† + 2.128** = 26.50	77.5
Top 15 taxa 26.50 + 0.108 + 0.617 + 0.865 + 0.886 + 0.132 + 0.316 + 0.413 + 0.123 + 0.686 + 0.309 + 0.628 = 31.58	92.4
Top 28 taxa 34.184 − 2.259 = 31.925	93.4

* *Eriophorum angustifolium* ssp. *subarcticum* and *E. triste* (= *E. angustifolium* ssp. *triste*) were not separated in the quadrat data; however, subsequent field observations have shown *E. triste* to be primarily limited to moist tundra sites and *E. angustifolium* ssp. *subarcticum* to wet sites. If this ecological separation is valid, then *E. triste* covers about 2.7% of the region and *E. angustifolium* ssp. *subarcticum* about 2.1%. Thus, both taxa are among the four most abundant taxa in the region.

† The cover value for *E. triste* is the sum of the values for *E. angustifolium* in dry and moist vegetation types (B1, B2, B3, U2, U3 and U4).

** The cover value for *E. angustifolium* ssp. *subarcticum* is the sum of the values for *E. angustifolium* in wet and aquatic vegetation types (M1, M2, M4, M5 and E1).

Table 55. Floristic breakdowns for the most common taxa in the Prudhoe Bay region.

	Number of taxa (Percent of taxa)				
	Percent of map area covered by each taxon			*All taxa in Table 54*	*Total flora*
	>1% *(4 taxa)*	*>0.5%* *(9 taxa)*	*>0.1%* *(15 taxa)*	*(28 taxa)*	*(223 taxa)*
Environment					
Arctic-alpine	3(75.0)	6(66.7)	8(53.3)	16(57.1)	107(48.0)
Arctic	1(25.0)	3(33.3)	5(33.3)	8(28.6)	74(33.2)
Arctic-boreal	0(0)	0(0)	1(6.7)	2(7.1)	25(11.2)
Coastal	0(0)	0(0)	1(6.7)	2(7.1)	17(7.6)
Geographic range					
North America	1(25.0)	1(11.1)	1(6.7)	1(3.6)	16(7.2)
North America-Asia	0(0)	1(11.1)	2(13.3)	4(14.3)	67(30.0)
East North America	0(0)	0(0)	0(0)	0(0)	5(2.2)
Circumpolar	3(75.0)	7(77.8)	12(80.0)	21(75.0)	116(52.0)
Northwest America	0(0)	0(0)	0(0)	2(7.1)	12(5.4)
West North America-Asia-Europe	0(0)	0(0)	0(0)	0(0)	7(3.1)
Northern limit					
Zone 1	2(50.0)	2(22.2)	2(20.0)	5(17.8)	31(13.9)
Zone 2	2(50.0)	3(33.3)	5(33.3)	14(50.0)	89(39.9)
Zone 3	0(0)	4(44.4)	6(40.0)	8(28.6)	85(38.1)
Zone 4	0(0)	0(0)	1(6.7)	1(3.6)	18(8.1)

Table 56. Floristic analysis of the 15 most common plants at the Sagwon upland and Prudhoe Bay.

	Number of taxa (Percent of taxa)	
	*Sagwon Upland**	*Prudhoe Bay*
Environment		
Arctic-alpine	8(53.3)	8(53.3)
Arctic	3(20.0)	5(33.3)
Arctic-boreal	4(26.7)	1 (6.7)
Coastal	0 (0)	1 (6.7)
Geographic range		
North America	0 (0)	1 (6.7)
North America-Asia	4(26.7)	2(13.3)
East North America	0 (0)	0 (0)
Circumpolar	9(60.0)	12(80.0)
Northwest America	1 (6.7)	0 (0)
West North America-Asia-Europe	1(6.7)	0 (0)
Northern limit		
Zone 1	0 (0)	3(20.0)
Zone 2	7(46.7)	5(33.3)
Zone 3	6(40.0)	6(40.0)
Zone 4	2(13.3)	1 (6.7)

* Unpublished personal data.

of the total cover, and also when we include all the taxa in the total flora. Circumpolar taxa are predominant among the plants with greatest cover values. Eighty percent of the top 15 taxa are circumpolar, compared to 52% for the entire flora.

At the Sagwon upland, a typical area of tussock tundra in Young's Zone 4 about 110 km south of Prudhoe Bay, the top four plants are *Eriophorum vaginatum, Ledum palustre* ssp. *decumbens, Betula nana* ssp. *exilis* and *Vaccinium uliginosum* ssp. *microphyllum.** All of these are Zone 3 plants (Table 56). Of the top 15 plants, 47% are high arctic, but there are no Zone 1 plants. Sixty percent are circumpolar, 27% are arctic-boreal, and 27% North American-Asian.

* Unpublished personal data.

The only distinct trends evident in comparing Young's floristic categories and site moisture were a shift toward Zone 4 plants in the emergent sites and a lack of Zone 1 plants in these areas. A closer look at individual vegetation types in the dry end of the gradient showed that Zone 1 plants tend to be concentrated in areas with high levels of cryoturbation.

GROWTH OF *SALIX LANATA* ALONG THE SUMMER TEMPERATURE GRADIENT

Introduction

The lower temperatures near the coast cause not only floristic changes but also major changes in stature within species. This is perhaps best illustrated with shrubs. The heights of willows along the coastal plain river systems decrease from nearly tree-sized shrubs at the northern edge of the foothills to prostrate forms at the coast. The variety, abundance and stature of shrubs are key criteria in most systems of floristic and vegetation subdivisions within the Alaskan Arctic.

This section discusses the results of a willow transect study along the Sagavanirktok River (Fig. 65) in light of some of these biogeographic considerations. The objective of this study is to correlate willow height and growth rings with the temperature gradient and to relate this information to the vegetation subdivisions of the coastal plain.

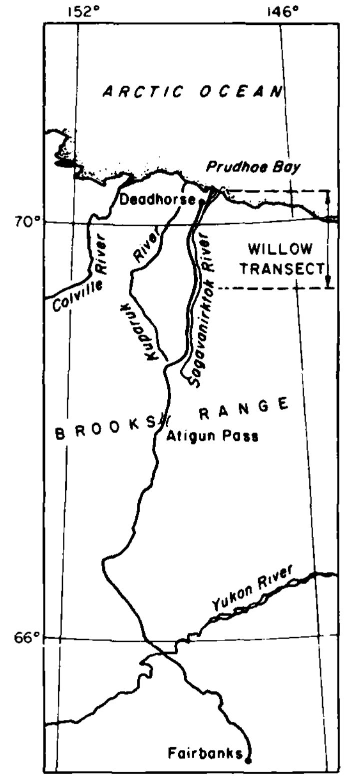


Figure 65. Location of the willow transect. The transect is approximately 100 km long.

Salix lanata ssp. *richardsonii*, the subject of this investigation, is a shrub willow that is particularly abundant on the Arctic Coastal Plain in the vicinity of the Sagavanirktok River. In this region it is apparently a basophile that thrives in the calcium-rich alluvium and eolian deposits that border the Sagavanirktok River. It is infrequent in the acidic upland tundra of the foothills. This taxon is the western North American-eastern Asian race of the Eurasian *S. lanata* and is a part of a circumpolar complex consisting of the subspecies *richardsonii*, *lanata* and *calcicola*. The latter two subspecies occur in the eastern Canadian Arctic (Argus 1973). Distribution maps by Hultén (1968) and Viereck and Little (1975) show occurrences of *S. lanata* ssp. *richardsonii* slightly south of the coast across northern Alaska.

The height of *S. lanata* depends on several factors. It is often abundant but stunted on the open tundra. Here the soils are thoroughly saturated and nutrient poor, the winter snow is shallow, and the permafrost is close to the surface. In low-centered polygon complexes it prefers the more mesic conditions of the polygon rims, but often the tallest open-tundra willows are found in the troughs between the rims, where there is protection from the winter winds and snow abrasion. In these sites, however, open-tundra willows rarely exceed 50 cm in height, even at the southern end of the transect. The willow grows best along rivers, possibly because of warmer soils, better nutrient regimes, and the protection provided by deep but early melting snowbanks.

Salix lanata is a good plant to study along the temperature gradient because 1) it is a woody species with a multi-year growth record, 2) it is abundant and easy to collect, and 3) it exhibits nearly its full range of growth potential along the Sagavanirktok River transect.

Sagavanirktok River transect

The transect, which follows the Dalton Highway, offers a unique opportunity to study the ecological effects of a very steep temperature gradient over a flat surface. Except for summer temperatures, the environment along the Sagavanirktok River is remarkably uniform, mostly due to the transect's flatness. The total elevation gain in over

Table 57. Environmental data for the willow transect.

			Precipitation (mm)†					Wind** (28 June-3 Sept 1977)	
	Distance from coast		Thaw season			Total		Mean velocity	
Station	*(km)*	*Soil pH**	*1976*	*1977*	*1978*	*1977*	*1978*	*(km/hr)*	*Direction*
Prudhoe Bay, Wyoming snow gauge	6	7.6		101	83	266	178		
Deadhorse	12	7.8			58			15.0	NE
Franklin Bluffs	37	7.6	56	101				12.4	NE
Sagwon Upland	102	5.9	74	145	61	238	140	9.8	SE & SW

* Data from Webber et al. (1978).
† Unpublished CRREL data.
** Unpublished data from K. Everett, Ohio State University, 1979.

100 km is only about 150 m. Table 57 summarizes most of the available data for other site factors. Komárková (in Webber et al. 1978) measured the soil pH at 17 sites along the transect and found the soils to be consistently basic on the coastal plain, with pH 7.5 ± 0.18 (S.D). She found one acidic sample at the southern end of the transect in the foothills.

The precipitation data from the transect are sparse, but Haugen and Brown (1980) concluded from this and data from several sites on the coastal plain that there is no substantial difference in precipitation between littoral areas and inland areas. There are no available fog data for the transect, but fog is common at the coast and less common inland.

Snowpack data are available only for Prudhoe Bay, where the average wind-packed snow depth is between 30 and 40 cm (Benson et al. 1975, Everett and Parkinson 1977). Observations indicate that the snowfall amounts do not vary greatly along the length of the transect. A more important consideration with regard to willow growth is the depth of snowdrifts, particularly in drainage channels. The highest willows are invariably found in areas where there is enough microrelief variation to create moderately deep snowbanks in winter. While snow depth is an important consideration, there is no evidence to suggest that the willows on the northern end of the transect are shorter because of a lack of deep snow microsites.

The only factor, other than temperature, that could be an important variable with respect to willow growth is wind. Summer wind data for 1977 (Everett 1980b) show the main wind direction to be from the northeast at Prudhoe Bay and Franklin Bluffs, particularly during the early part of the summer. During the end of July and all of August a southerly component becomes important as the Arctic Front weakens and warm air spreads from inland toward the coast. Winter winds are consistently from the northeast at Prudhoe Bay (Gamara and Nunes 1976). Summer winds were somewhat stronger at Prudhoe Bay than at Franklin Bluffs or the Sagwon upland in 1978 (Table 57). The mean 1978 summer velocity at Prudhoe Bay was 15 km/hr, compared to 12.4 km/hr at Franklin Bluffs and 9.8 km/hr at the Sagwon upland. The biological importance and the regularity of these differences need to be investigated further. Overall, it would be difficult to imagine a more uniform environment on which to overlay a steep temperature gradient.

Details of the temperature gradient

The National Weather Service has been recording summer temperatures at Prudhoe Bay since 1970. They also reported temperatures at all the pipeline construction camps during construction of the road and pipeline from 1975 to 1977. CRREL researchers have continued to monitor temperatures at the construction camps and several additional sites since 1976. Six of the stations—West Dock, Drill Site 2, Pad F, Arco, Deadhorse and Franklin Bluffs—are on the coastal plain (Fig. 66). Data from these stations and a site on the Sagwon upland, located in the foothills at the southern edge of the coastal plain, have been used to portray the temperature gradient (Table 47) (Haugen 1980).

The mean summer temperatures decrease exponentially near the coast (Fig. 67) due to the influence of the cold sea. The temperature gradient is considerably steeper than was recognized by previous investigators before data from inland stations were available (e.g. Conover 1960). Temperatures

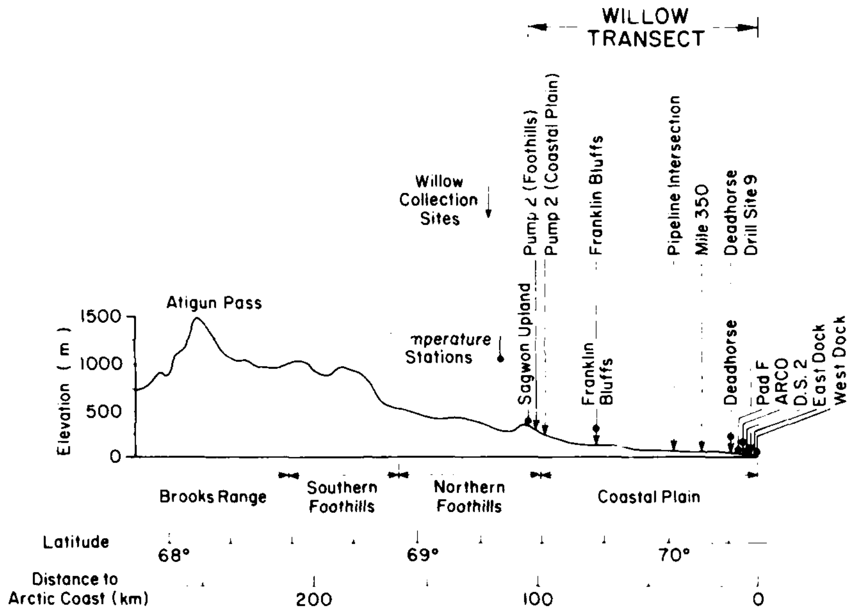


Figure 66. Location of temperature stations and willow collection sites.

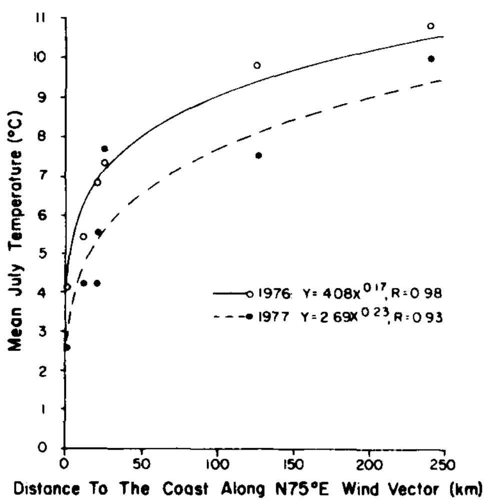


Figure 67. Temperature gradient along the coastal plain section of the trans-Alaska pipeline. This correlation is slightly higher than with the shortest distances to the coast. Points represent temperatures at stations shown in Figure 66.

at the coast are close to freezing for most of the summer, and accumulation of thaw degree-days is often less than 300°C (Fig. 68). At the southern end of the coastal plain the mean July temperature is near 10°C and the number of total thaw degree-days is over three times that at the coast (Table 47).

Growth rings in willows

Growth rings are commonly used for detecting variations in summer warmth (Douglas 1919, Hustisch 1948, Glock 1955, Polunin 1955, LaMarche 1974, Fritts 1976). The amount of woody stem tissue added annually represents the excess of photosynthates not used for metabolic processes (Fritts 1976). Trees have been shown to exhibit smaller, more irregular annual growth rings at lower temperatures. Rings in woody shrub species are also reduced and more variable near their northern limit. However, many environmental factors besides air temperature can influence the size of radial increments, including moisture, soil temperature, wind, nutrients and competition (Fritts 1976). External factors, such as fire, pollution and

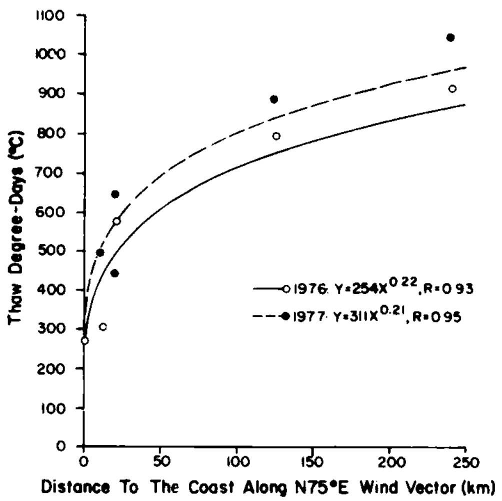


Figure 68. Thaw degree-days along the willow transect.

herbivores, are also important, as are naturally occurring factors related to growth and phenology, such as leaf area, crown size, flowering and senescence (Fritts 1976).

Clearly many site and biological factors affect the size of annual ring increments, and extreme care must be used in ascribing variations to any single factor. In this study no detailed analysis of each site was made, nor were notes taken regarding the status of individual specimens. The collections were made quickly from nearly equivalent sites with the sole intent of seeing if there was an obvious trend in the size of open-tundra *Salix lanata* growth rings corresponding to the temperature gradient. Naturally all of the factors mentioned above would also have an influence and could mask or distort the effects of temperature.

The use of angiosperms for growth ring analysis is not particularly common. Gymnosperms are used whenever possible because they have small wood cells that produce neat, orderly rings. Angiosperms have large-diameter vessels, resulting in porous wood. The vessels distort the accompanying fibers, making interpretation difficult (Panshin et al. 1964). Angiosperms can also produce more irregular rings because of phenological factors, such as large annual differences in flower and seed production. However, since there are no common gymnosperms on the Arctic Slope of Alaska, dendrochronological studies are limited to angiosperms. *Salix lanata* is a ring-porous angiosperm with a marked difference between the cells produced in early spring and those produced in summer.

The literature regarding growth ring studies in the Arctic is sparse. Warren Wilson (1964) cited several old papers from Europe (Kraus 1874, Warming 1888, Ambronn 1890, Kihlman 1890) that record growth rings for a variety of arctic species. Warren Wilson used these data, his own *Salix arctica* data from Cornwallis Island, and other data from subarctic areas (Middendorf 1867, Cooper 1931, Hustisch 1948) to relate the mean thickness of annual rings to the severity of the climate. He found that the mean thickness varied from 0.07 mm in the High Arctic on Cornwallis to 2.73 mm in the Subarctic of southern Alaska. These values were only for deciduous taxa such as *Salix* and *Betula* and did not include ericaceous shrubs, which have comparatively narrow rings. Values from the Middle and Low Arctic (Polunin 1951) ranged from 0.21 to 0.71 mm.

Beschel and Webb (1962) studied *S. arctica* on Axel Heiberg Island. They commented on the large number of growth irregularities for this taxon. The annual ring increments varied from 0 to 0.8 mm; the average was 0.2 mm.

Raup (1965) examined *Salix arctica* growing on turf hummocks in Greenland. He found that rings often showed reductions in width, presumably due to physical injury caused by soil movement, desiccation or rodents. Frequent suppressions such as those described by Raup were also apparent in *S. lanata* along the willow transect, although the causes of suppressions are likely to be different.

Methods

Field work

Seven locations (Fig. 66) were selected for measuring heights and collecting *S. lanata* in July 1977. Four of these—Drill Site 9, Deadhorse, Mile 350, and Pipeline Intersection—were established within 40 km of the coast to measure willow growth in the steepest part of the temperature gradient. The two stations at the southern end of the transect—Pump 2 (Coastal Plain) and Pump 2 (Foothills)—were within 2 km of each other to see if the better-drained environment on the upland affected the height of open-tundra willows. Another measurement site was added in 1980 near the East Dock about 0.5 km from the coast in the northernmost stand of open-tundra willows along the transect.

At each location the heights of 50 willows were measured in a streamside site and 50 on an open-tundra site (Table 58). An attempt was made to measure only the tallest, most fully developed willows. Fifty willows (without their roots) were col-

Table 58. Summary of willow height data along the Sagavanirktok River.

Station	Distance to coast (km)	Predicted mean July temperature* (°C)	Predicted mean TDD* (°C)	Height of open-tundra willows (cm) Mean	Standard deviation	Height of streamside willows (cm) Mean	Standard deviation
East Dock	0.7	3.3	288	10.5	1.9	0.0	0.0
Drill Site 9	4.0	4.9	437	10.3	1.9	10.3	2.2
Deadhorse	12.0	6.3	569	28.7	5.6	21.6	8.6
Mile 350	25.0	7.5	679	26.6	3.8	40.3	8.3
Pipeline intersection	37.0	8.2	746	28.6	5.7	92.6	16.2
Franklin Bluffs	70.0	9.5	869	35.4	9.5	109.4	16.1
Pump 2-Coastal Plain	98.0	10.2	943	37.2	7.5	146.7	25.4
Pump 2-Foothills	100.0	10.3	947	35.7	12.2	148.8	28.9

* Based on regressions of 1976 and 1977 temperature data (Haugen 1979) from seven sites along the haul road transect (Fig. 66).

lected from each open-tundra location for analyzing growth rings. The decision to collect willows from open-tundra rather than streamside sites was based on logistics. The open-tundra specimens were considerably smaller and were easier both to handle and to section for counting growth rings. It was later noted that the mass of the 50-willow bundles from each site could serve as a rough index of net aboveground productivity.

Growth ring analysis

The willows were sectioned and mounted according to procedures outlined by Jensen (1962). The stems were dehydrated for 2 weeks in alcohol. They were then sectioned in 10-μm slices, mounted, fixed by Mayer's albumin, and allowed to dry for 24 hours. They were stained with safranin and fast green, cleared in clove oil, and mounted in Permount medium.

The slides were studied by projecting them on a wall using a Leitz microscope-slide projector. The annual rings were marked on long strips of paper along two radii for each section. The two radii were compared, and missing or false rings were noted. *Salix lanata* has distinct rings in most cases, but numerous individuals had indistinct records. Twenty-five sections were analyzed for each of the seven stations; thus, 175 willow sections were used in the analysis. An attempt was made to pick specimens with the clearest growth records.

Data analysis

Frequency distributions and basic statistics for the willow height data were obtained using the SPSS Frequencies subprogram (Nie et al. 1975). Fourteen subsets of data, representing the height measurements at two sites (open tundra and streamside) at seven localities, were analyzed. To correlate height of the shrubs with distance from the coast, mean July temperature and thaw degree-days (TDD), an INSTAAR graphics regression routine was used. The temperatures and TDDs at each station were obtained from the best-fit regression equations. This information was used to calculate regression equations with July mean temperature and TDDs as independent variables and willow height as the dependent variable.

The growth ring data were analyzed in the same way. Subsets of growth rings representing the first 10 years of growth, the middle 10 years, and the last years of growth were compared against distance from the coast using regression.

Results

Willow heights

Willow height increases as an exponential function of distance from the coast (Fig. 69) and thaw degree-days (Fig. 70). Open-tundra willows have a nearly linear response to temperature, while streamside willows respond much more dramatically to increased warmth. Near the coast, open-tundra willows average 10 cm high. At the edge of the foothills, open-tundra willow heights average 37 cm. In contrast, streamside willows vary from 10 cm at Drill Site 9 to 147 cm at the foothills. Areas with less than 400 TDDs are likely to have taller willows in open-tundra areas than in streamside sites (Fig. 70).

The upper heights of streamside willows should level off. Argus (1973) listed the height of *S. lanata* as varying between 60 and 300 cm, with a record height of 700 cm, and Viereck and Little (1972) stated that the upper limit is usually 200 cm. At the base of the foothills (100 km from the coast), where there are approximately 900 TDDs

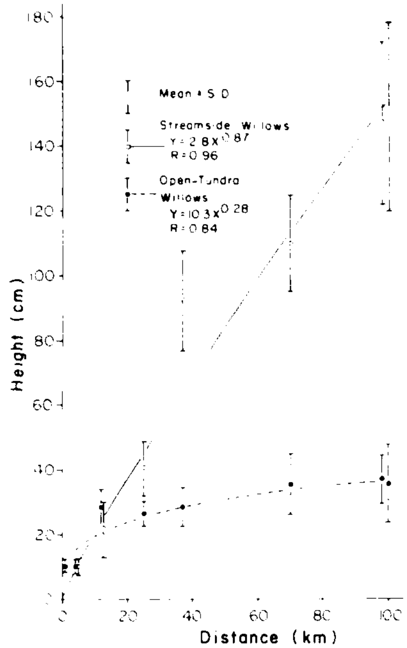


Figure 69. Willow height vs distance from the coast.

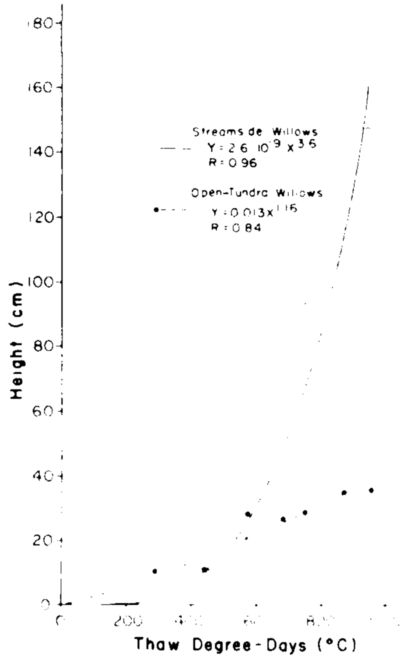


Figure 70. Willow height vs thaw degree-days. Temperatures at each willow collection site are predicted values based on 1976 and 1977 data (Haugen 1979).

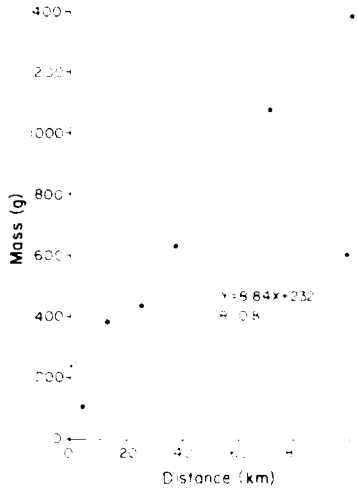


Figure 71. Mass of 50 willow stems vs distance from the coast.

annually, the taxon is approaching this limit. The height of open-tundra willows appears to level off at around 50 cm.

The aboveground biomass of open tundra willows shows a 14-fold increase along the transect (Fig. 71); the heights show only a 3-fold increase. However, the willows were not collected with the intention of measuring biomass. The heights were measured on only the most robust specimens at a location, but smaller specimens were included for growth-ring analysis.

Growth rings

The growth ring data are summarized in Table 59. Most of the sectioned willows, 107 of 175, were in the 16- to 30-year age class (Fig. 72). Twenty-eight willows were younger than this, and 40 were older. The oldest willow had 60 growth rings, and the youngest had 8. The mean ring width for all 175 willows was 133 μm. The subset of willows in the 16- to 30-year age class was used for regression analysis of mean increment widths to compare roughly equivalent age groups. The correlation of mean increment width for this subset vs distance from the coast is highly significant ($P \leq 0.001$) (Fig. 73). Mean width increases from 90 μm at Drill Site 9 to 182 near Pump Station 2. Ring widths at the coast are comparable to those reported in *S. arctica* by Warren Wilson (1964) for Cornwallis Island in the High Arctic. The value at Pump Station 2 is less than the range reported for the Middle and Low Arctic.

Table 59. Summary of growth ring data. **Data represent 25 open-tundra willows collected at seven stations along the Sagavanirktok River.**

	Ring width (µm)										
	All 175 willows		*Willows in 16- to 30-yr age class (107 willows)*								
	All rings		*1st ten rings*		*Middle ten rings*		*Last ten rings*		*All rings*		*No. of*
Station	$\bar{X}$	*S.D.*	$\bar{X}$	*S.D.*	$\bar{X}$	*S.D.*	$\bar{X}$	*S.D.*	$\bar{X}$	*S.D.*	*willows*
Drill Site 9	94	20	103	26	79	18	63	17	90	15	17
Deadhorse	138	55	134	43	115	54	115	51	108	29	12
Mile 350	103	19	114	24	87	30	77	31	105	19	21
Pipeline intersection	92	19	120	36	66	17	62	17	105	15	13
Franklin Bluffs	155	64	182	56	123	63	98	60	150	20	12
Pump 2-Coastal Plain	150	50	174	41	108	53	84	47	131	33	15
Pump 2-Foothills	118	57	220	53	155	63	125	55	182	35	17
Total	133	55	149	57	104	54	89	48			107

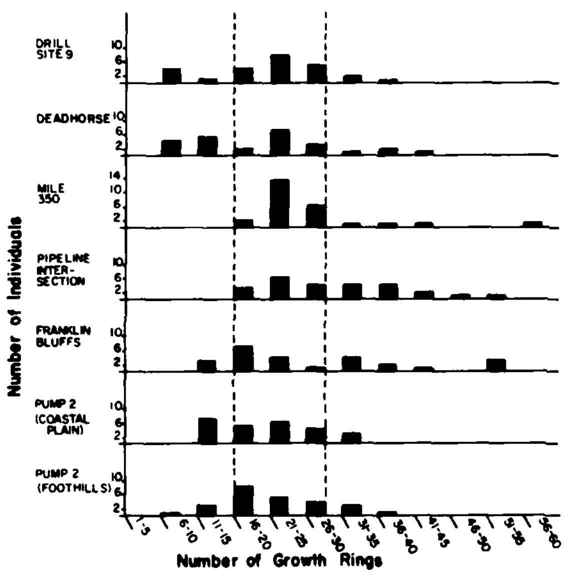


Figure 72. *Age classes of willow collections. Willows between the ages of 16 and 30 (dashed lines) were used for the regression analysis.*

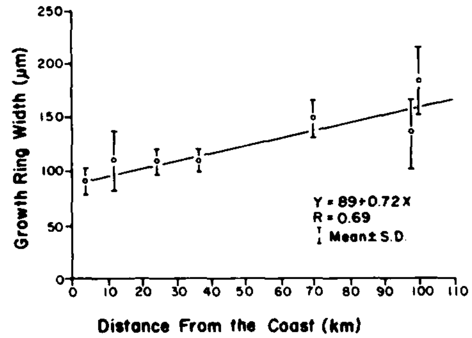


Figure 73. Open-tundra willow growth ring width vs distance from the coast. Data represent only the age class of 16-.0 years.

Regressions for the subsets of ten inner, ten middle and ten outer growth rings (Fig. 74) show major differences between the groups. The inner ten widths have the highest correlation (R = 0.63) with distance from the coast. The correlation with thaw degree-days is somewhat lower (R = 0.56). The correlations for the middle and outer ten ring widths are considerably lower (R = 0.34 and 0.21 respectively), but both are significant ($P \leq 0.01$). The narrow rings in the outer part of most stem radii are apparently more a function of the natural senescence of the plant and are not strongly correlated with summer warmth.

Discussion

This study illustrates that *Salix lanata* can be an important dendrochronological tool in northern Alaska, where there is a lack of gymnosperms and other taxa that have been traditionally used for growth ring studies. The fact that the stature and productivity of this shrub, and probably others, vary predictably with temperature across the coastal plain has implications regarding the division of northern Alaska into vegetation subzones.

The stature and productivity of shrubs are key criteria in all the various vegetation and floristic

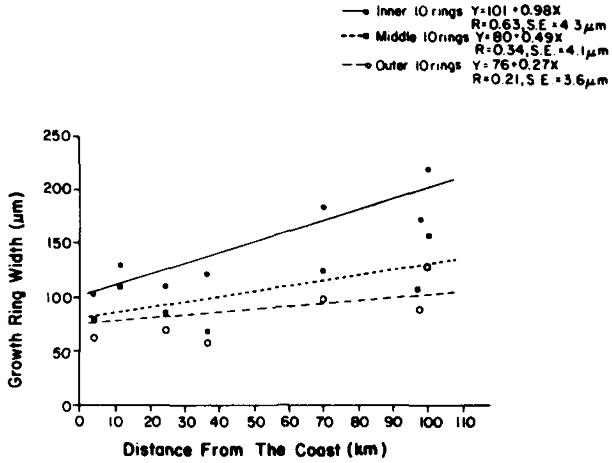


Figure 74. Mean growth ring widths for the inner ten, middle ten, and outer ten growth rings.

Table 60. North Slope shrub data from Komárková and Webber (1979).

Region	*Distance from coast (km)*	*Number of samples*		*Cover of deciduous shrub layer (% ± S.D.)*	*Height of shrubs (m ± S.D.)*
		Open tundra	*Stream bottom*		
Coastal	0–25	9		2 ± 2.4	0.09 ± 0.086
Coastal Plain	30–95	12	1	6 ± 4.3	0.22 ± 0.048
Northern Foothills	100–135	8	3	28 ± 25.8	0.56 ± 0.572
Southern Foothills	140–190	13		12 ± 9.0	0.24 ± 0.149
Brooks Range	195–245	15		18 ± 20.0	0.16 ± 0.122

systems for dividing the Arctic into subzones. Polunin (1951) noted that ". . . the vegetable productivity on land increases more markedly than the totality of species as we travel further south . . ." and that most of this increased productivity is due to the increased importance of shrubs and dwarf shrubs. Andreev (1966) similarly noted in the East European Arctic that the subzone of the northern tundra [the northern belt of the subarctic tundra subzone of Alexandrova (1970)] is characterized by well-developed willow scrub of *Salix glauca, S. phylicifolia* and *S. lanata.* Farther south, particularly in Canada and the U.S.S.R., the tundra in areas with adequate snowcover becomes even more dominated by shrubs, with a preponderance of dwarf birch (*Betula nana*) and shrub willows, characteristic of the southern subzone of the subarctic tundra of Alexandrova (1970) and Andreev (1966).

The changes in the total cover and height of all shrubs along the transect are illustrated by data from a recent study by Komárková (Komárková and Webber 1979). She sampled vegetation at 5-km intervals along the haul road from the Yukon River to Prudhoe Bay. Part of her sampling included measuring the height and the percentage of cover of the shrub layer. Nearly all of the North Slope samples were from open-tundra sites; very few were streamside sites. However, the open-tundra samples (Table 60) include a wide variety of habitat types, including tussock meadows, boggy sites, and dry uplands. On the basis of her vegetation data, Komárková divided the North Slope portion of the transect into five regions: 1) coastal, 2) coastal plain, 3) northern foothills, 4) southern foothills and 5) Brooks Range. The distances of the regions from the Beaufort Sea are shown in Table 60. Her data show that shrubs have their

greatest height and cover values in the northern foothills and that shrubs become less abundant and shorter on the coastal plain. Near the coast, shrubs diminish further.

Several authors have discussed the effect of temperature on the physiognomic aspects of the northern Alaskan vegetation. Cantlon's (1961) littoral tundra is a narrow band across the northernmost limit of the Alaskan arctic coastal plain, and it is approximately delimited by the 7 °C July mean isotherm. He based this zone on a similarly named subzone in the U.S.S.R. (Sheludiakova 1938). This boundary was also drawn by Alexandrova (1970) to separate the northern subarctic subzones. It is also approximately the same region that Komárková termed the coastal region (Komárková and Webber 1979). The vegetation of the northern region in these classifications is characterized by poor development of shrub, dwarf-shrub and tussock tundra and a scarcity of ericaceous shrubs. Clebsch and Shanks (1968) found the same trend along a transect from Barrow to Atkasook, Alaska. The contrasts between oceanic and continental arctic vegetation have also been noted in Greenland (Sørensen 1941, Bocher 1954).

Cantlon's and Sheludiakova's littoral tundra is the area with a July mean temperature less than 7 °C. Along the transect of this study, littoral tundra, based on 1976 and 1977 temperatures, occurs within 15–22 km of the coast measured in the direction of the wind (Haugen and Brown 1980) (Fig. 68). This area had less than 600 annual TDDs in 1976 and 1977. The height of *Salix lanata* is less than 25 cm, even in protected, streamside environments (Fig. 68 and 69). Although it is not a good practice to draw boundaries on the basis of two summers' data, the 1976 July mean temperature was near the 8-year mean at the ARCO station, and the width of the littoral strip as indicated by the temperature curves is probably at least close to a boundary based on several summers' data.

S. lanata and *Cassiope tetragona* are the only common erect shrubs within the littoral strip. All other willow and shrub species in this region have creeping or matted growth forms. Immediately adjacent to the coast, where July mean temperatures are 4 °C or less and the total TDDs are less than 400, *Salix lanata* does not occur in streamside sites and is extremely stunted on the open tundra. South of Deadhorse the abundance, diversity and stature of willows increase dramatically. At 30 km from the coast, *S. lanata* exceeds dwarf-shrub stature (50 cm, Fig. 69) in protected, streamside environments, and other erect willows, including *S. alaxensis, S. niphoclada* and *S. glauca*, become more common. It is apparent that the allocation of plant productivity for woody support tissues becomes a lower priority in the northern Arctic. This affects both the amount of aboveground biomass for individual taxa and the amount of vegetation as a whole.

Because of the gradual macrorelief changes on the arctic coastal plain of Alaska, the changes in vegetation are continuous but subtle. Consequently it is difficult to draw boundaries for vegetation subzones within this physiographic province. Nonetheless, changes do occur, and they can be related to the composition and physiognomy of the shrub vegetation. Efforts to map the vegetation of northern Alaska depend heavily on remote sensing data. Landsat imagery and high-altitude photographs cannot distinguish tundra community floristics, but the abundance and stature of shrubs can in many instances be interpreted and are thus more useful criteria for defining broad vegetation boundaries. The information from photographs could be complemented with temperature isotherm data (e.g. Haugen and Brown

Table 61. Shrub subzones along the Sagavanirktok River on the Arctic Coastal Plain.

Subzone	Distance from coast (km)	Height (cm) of Salix lanata: Open tundra	Height (cm) of Salix lanata: Protected streamside	Dominant tundra types: Wet	Dominant tundra types: Open tundra, Moist	Dominant tundra types: Open tundra, Dry	Dominant tundra types: Protected streamside
Immediate coast	< 1	< 15	None	Wet sedge tundra	Sedge, dwarf shrub tundra	Dwarf shrub, crustose lichen tundra and barren	Sedge, dwarf shrub tundra
Northern Coastal Plain	1-30	< 25	< 50	Wet sedge tundra	Graminoid, dwarf shrub tundra	Dwarf shrub, crustose lichen tundra	Dwarf shrub tundra
Mid- and Southern Coastal Plain	30-100	< 50	< 200	Wet sedge, dwarf shrub tundra	Tussock sedge, dwarf shrub tundra and dwarf shrub tundra	Dwarf shrub, forb, crustose lichen tundra	Medium-height shrub tundra

1980) to aid in producing small-scale vegetation maps of northern Alsaka.

Using the information from the willow transect, the vegetation along the Sagavanirktok River can be divided into three subzones (Table 61). The subzones are based mainly on the stature of shrubs in the most protected streamside sites. The immediate coastal subzone (< 1 km from the sea) has no erect willows in streamside sites. The northern coastal plain subzone (1-30 km from the sea) has streamside *S. lanata* no higher than 50 cm. The mid- and southern coastal plain subzone (> 30 km from the sea) has streamside willows taller than 50 cm. These regions can be related to the summer temperature regime (Fig. 63, 67 and 68), but a firm statement should wait until data from a longer period of record are available. Also the streamside willow heights are from the most protected sites at each location, and no data are currently available on the "average" willow heights in streamside or open-tundra environments. Table 61 also gives a summary of the typical open-tundra types that occur along the moisture gradient within each of the shrub-defined subzones.

SUMMARY

The floristic analysis showed that most of the mapped area at Prudhoe Bay is in a transition zone between the cold coastal climate to the north and the more moderate climate to the south. Along this gradient the vegetation changes from a tundra dominated by high arctic, mostly circumpolar taxa with a coastal element to a low arctic tundra with higher percentages of Asian and northern American taxa. The inland tundra also has a larger arctic-boreal element and a much smaller coastal element.

The analysis with respect to site moisture shows that the arctic-alpine taxa are concentrated toward the dry end of the moisture gradient and the arctic-boreal taxa are concentrated toward the wet end. The Asian and northwest American taxa also are concentrated toward the dry end of the gradient, with a preponderance of circumpolar taxa in the wet end.

The study regarding *S. lanata* illustrated the strong relationship between the summer temperature regime and the height and growth rings of this shrub taxon along the Sagavanirktok River. Further studies with other taxa and other areas of the coastal plain would be helpful and would serve as an excellent source of data for establishing physiognomic criteria for dividing the Alaskan Arctic into subzones. Floristic information, such as that of Young (1971), Murray et al. (1977), Komárková and Webber (1979) and the first part of this chapter, complements the shrub information and gives added meaning to shrub-defined regions.

CHAPTER 6. SUMMARY AND CONCLUSIONS

The Prudhoe Bay region is a particularly interesting area of tundra because of its well-defined and steep environmental gradients, the combination of which has not been described for any other place in the Arctic. It is a region of wet coastal tundra that has a unique substrate pH gradient, which is due in part to its coastal location. The prevailing northeast winds distribute loess from the Sagavanirktok River over most of the region. The northwest portion of the region is not downwind from the river and consequently has acidic tundra; areas downwind from the river have alkaline tundra with a gradient of declining soil pH values away from the river. The coastal temperature gradient is among the steepest in the Arctic. Three of Young's (1971) four floristic zones, which are based on the amount of total summer warmth, are present within the region. The effects of the temperature gradient can be seen in the increase in the total number of plants in the flora and the increased plant productivity, particularly of shrubs, as one moves inland. The predominantly wet landscape also creates steep vegetation gradients within elevation changes of a few centimeters. Small hummocks and higher microsites associated with ice wedge polygon relief may be elevated only 10–25 m above the level of saturated soils but can support rich mesic tundra plant communities. Thus the vegetation at each point in the tundra is a product of numerous microscale, mesoscale and macroscale environmental gradients.

MICROSCALE GRADIENTS

The moisture gradient is the most important microscale influence and accounts for most of the variation on the regional vegetation maps (Walker et al. 1980). Map boundaries of landforms, soils and vegetation are mostly controlled by variations in patterned ground forms. Topographic variation of a few centimeters has major effects on plant composition due to the flat, flooded landscape and perched water tables that are a result of permafrost.

Soil moisture affects a variety of soil properties, including pH, nutrient regimes and the percentage of organic matter. These changes are similar to those described for wet soils of temperate regions. Organic matter is higher in wet sites, directly affecting water retention, bulk density, thaw depth and soil pH. Soil nutrients are generally negatively correlated with soil moisture, with the exception of ammonium, which has its greatest concentration in wet sites.

Plant taxa respond to various factors related to the moisture gradient. Of the site factors analyzed, hummock size and slope are correlated with the most taxa, while the actual percentage of soil moisture seems to be less important. Organic matter and available water are important to moisture conditions near the surface layer in relatively drier soils and are most important to the cryptogams. Of the moisture-related nutrients, phosphorus shows the most and strongest correlations with plant taxa, followed by nitrates, potassium and ammonium.

Other microscale gradients, such as snow depth, cryoturbation and animal activity, were studied in less detail; lists of plants correlated with subjective ratings for these factors were compiled. Cryoturbation is a particularly important factor worthy of more detailed study within the region.

Data are presented in the appendices to document 42 vegetation types. Environmental and species information from 92 permanent study plots provide an extensive data base for future studies in the region. Detailed vegetation maps and planimetry data for a 140-km^2 area are also part of the data base and provide a valuable historical baseline for this recently developed area.

MESOSCALE GRADIENTS

Carbonate-rich silt deposited downwind from the Sagavanirktok River influences a number of substrate factors, including percentage of organic matter, pH, soil particle size, water-holding capacity and soil nutrients. Studies in equivalent wet-tundra sites located at various distances from the

river show that organic matter, water retention, silt, clay and all soil nutrients increase away from the river, while sand, carbonates and pH decrease.

Most of the region has alkaline soils, but there is an area in the northwest part of the region that is relatively unaffected by loess, and the soils in this area are acidic. Nutrients increase toward the west due to greater percentages of clay and organic matter and presumably higher cation exchange capacities. In the acidic tundra areas, nutrient levels are comparable to the alkaline areas except for phosphorus, which is very low. The optimum pH for nitrates and calcium is near 7. Magnesium is highest in soils with somewhat lower pHs. Scattergrams of nutrient concentrations (except for ammonium) show distinctive clusters related to their geographic position within the oilfield.

The effects of the loess gradient on vegetation are difficult to isolate totally from moisture-gradient effects, but many taxa, particularly mosses, liverworts and lichens, show positive correlations with clay, calcium, magnesium and distance from the Sagavanirktok River. Only a few plants, including *Dryas integrifolia, Saxifraga oppositifolia* and several dune plants, are positively correlated with pH and carbonates.

The calcium gradient opposes the pH gradient, presumably due to low cation exchange capacities near the Sagavanirktok River. Numerous plants are positively correlated with calcium, while only a few are positively correlated with high pH. The region abounds with calciphiles, including *Chrysanthemum integrifolium, Carex saxatilis, C. scirpoidea, C. atrofusca, C. bigelowii, Pedicularis capitata, Salix reticulata, S. lanata, Drepanocladus* spp., *Scorpidium scorpioides, Tomenthypnum nitens* and numerous others. There is not a noticeable decline of calciphiles in the acidic tundra since the calcium levels are quite high throughout the region. There is, however, an increase in many presumably acidophilous plants, including *Salix planifolia* ssp. *pulchra, Saxifraga foliolosa, Luzula arctica, Polygonum bistorta, Vaccinium vitis-idaea, Dicranum* spp. and *Polytrichaceae*. *Sphagnum* is rare because of the high calcium levels.

The study of the loess gradient indicates that carbonate-rich sands and silts have a generally negative effect on vegetation. More dramatic effects can be expected from alkaline road dust where corridors pass through acidic, *Sphagnum*-rich tundra.

MACROSCALE GRADIENTS

The coastal temperature gradient is the primary macroscale gradient. The flora of the region was examined with respect to temperature and the moisture gradient. The height and productivity of the willow *Salix lanata* ssp. *richardsonii* were also analyzed with respect to the temperature gradient.

The presently known flora of the region consists of 238 vascular taxa, 25 hepatics, 117 mosses and 83 lichens. The vascular plant list is considerably larger than lists from Barrow and Fish Creek, reflecting the larger area of study, the greater diversity of habitats, and the higher temperatures inland. The cryptogam lists are probably still far from complete.

The floristic analysis of the region examined distribution patterns related to environment, geographic range and northern limits of distribution. The environmental distribution pattern shows that arctic–alpine plants predominate (48%) but there are also strong arctic (33%), arctic–boreal (11%) and coastal (8%) elements. The geographic pattern shows that most plants are circumpolar (52%) with a strong North American–Asian influence (30%). Very few plants have centers of distribution east of Prudhoe Bay (2%). These patterns are related to the glacial history of northern Alaska and Canada and the Beringian land bridge to Asia during the Pleistocene. The proximity of the Brooks Range, the presence of several large rivers flowing out of the mountains, and the migrational history of the flora contribute to the large percentage of arctic–alpine plants.

Most of the plants in the region have their northern limit in either Young's Zone 2 (southern high arctic, 40%) or Zone 3 (northern low arctic, 38%). Zone 1 (northern high arctic) plants account for 14%, and Zone 4 (southern low arctic) plants account for only 8%. There are higher percentages of high arctic taxa in the most frost-active areas. The arctic–alpine and Beringian influences are most pronounced in the dry vegetation stand types and decline markedly toward the wet end of the moisture gradient; circumpolar and arctic–boreal plants are more common toward the wet end.

Only four plant species cover more than one percent of the mapped area. These are *Carex aquatilis, Dryas integrifolia, Eriophorum angustifolium* ssp. *subarcticum* and *E. triste*. All of these

have their northern limit in the high arctic, which accounts for the high arctic character of the Prudhoe Bay vegetation. Vegetation in the foothills to the south is dominated by low arctic taxa.

The composition and stature of the vegetation are strongly affected by the temperature gradient. The percentages of coastal, circumpolar, Zone 1 and Zone 2 taxa decrease inland, while there are marked increases in the percentages of arctic, arctic-alpine, arctic-boreal, North American-Asian, northwest American, Zone 3 and Zone 4 plants.

South of Prudhoe Bay there is a dramatic increase in the total flora. The most notable additions are *Betula nana* ssp. *exilis, Ledum palustre* ssp. *decumbens, Dryas octopetala, Rhododendron lapponicum, Arctostaphylos rubra, Hedysarum mackenzii* and many willow species. The sizes of tussocks and shrubs also increase.

The heights of *Salix lanata* ssp. *richardsonii* along the coastal plain temperature gradient are decidedly different along streams than they are on the open tundra. Streamside willow heights are highly correlated with summer warmth and show an exponential relationship to total thaw degree-days. Streamside willows are virtually absent at the coast but grow to 200 cm high 100 km south of the coast. The response of open-tundra willows is less dramatic, they appear to grow to only about 50 cm high and are probably limited by windblown snow. Open-tundra *S. lanata* growth rings have a highly significant correlation with temperature, particularly during the first ten years of growth. Further studies regarding streamside willow growth rings should prove especially fruitful and are likely to reveal patterns correlated to the 30-year temperature record at Barrow. Studies with other taxa (e.g. *Salix planifolia* ssp. *pulchra*) are needed from acidic tundra areas.

Data from the floristic analysis and the shrub study can be used for a preliminary small-scale regional zonation that should prove useful for Landsat and aerial photographic interpretation on the coastal plain. Most shrub vegetation has high reflectivity of red and far-red radiation, making it distinct on color IR photography. However, the shrub data apply only to the coastal plain in the vicinity of the Sagavanirktok River. Other transect studies in other coastal areas are needed to make this information more widely applicable.

RELEVANCE TO OTHER STUDIES

This study and those involved with the production of the *Geobotanical Atlas of the Prudhoe Bay Region, Alaska* (Walker et al. 1980) have yielded an abundance of environmental information about a previously little known area of the Arctic. This tundra contrasts markedly with the well-known Alaskan arctic tundras at Barrow (Webber 1978, Walker 1977), Cape Thompson (Johnson et al. 1966), the Seward Peninsula (Racine 1974, 1975, 1977), the sand region west of the Colville River (Komárková and Webber 1978, Komárková, in prep.), Fish Creek (Johnson et al. 1978, Komárková and Webber 1978), Umiat (Churchill and Hanson 1958), Oumalik (Ebersole, in prep.) and Peters Lake (Batten 1977).

The tundra of northern Alaska is far less homogeneous than early impressions suggested. In many areas the controlling environmental gradients are subtle, thus emphasizing that in proposed areas of development, there is still a need for basic studies of soils, surficial geology, climate, tundra composition, productivity and phenology. These are a first necessary step in predicting the response of the local vegetation and other trophic levels to impacts. A thorough analysis of the natural vegetation in relationship to environmental factors will lead to meaningful experiments regarding impacts on tundra. For example, we now know from recent experiments and observations at Prudhoe Bay (e.g. Walker et al. 1978, Simmons et al. 1983, Walker, unpublished data) that the effects of road dust, oil and seawater vary considerably depending on soil moisture, soil pH, local temperature regime and the nature of the substrate. The simple experiments leading to these conclusions were designed to measure the impact on vegetation types along the known environmental gradients at Prudhoe Bay.

The correlation analyses and simple methods used in this report were an effective means of analyzing a rather limited data base from such a large area to demonstrate the existence and some of the effects of the local environmental gradients. The results are by no means definitive, but they can be used to help in designing more sophisticated experiments and exploring the changes to the system caused by anthropogenic disturbances. Controlled experiments utilizing multivariate approaches will help define individual plant responses and unravel the complexities of the interactions between environmental variables and between species. This study is thus a step toward a body of knowledge that can be used to accurately predict the influence of development-related impacts on tundra.

SELECTED BIBLIOGRAPHY

Abele, G., D.A. Walker, J. Brown, M.C. Brewer and D.M. Atwood (1978) Effects of low ground pressure vehicle traffic on tundra at Lonely, Alaska. USA Cold Regions Research and Engineering Laboratory, CRREL Special Report 78-16. ADA 061777.

Abele, G., W. Parrott and D. Atwood (1972) Effects of SK-5 Air Cushion Vehicle operations on organic terrains. CRREL Internal Report 269.

Acock, A.M (1940) Vegetation of a calcareous inner fjord region in Spitsbergen. *Journal of Ecology,* vol. 28, p. 81-106.

Adam, K.M. (1973) Winter road study. In *Towards an Environmental Impact Assessment of a Gas Pipeline from Prudhoe Bay, Alaska, to Alberta.* Environment Protection Board, Winnipeg, Manitoba. Interim Report No. 1.

Adam, K.M. (1974) Impact from winter road use and misuse. In *Environmental Impact Assessment of the Mackenzie Gas Pipeline from Alaska to Alberta.* Environment Protection Board, Winnipeg, Manitoba, Research Reports, Vol. 6.

Adam, K.M. and H. Hernandez (1977) Snow and ice roads: Ability to support traffic and effects on vegetation. *Arctic,* vol. 30, no. 1, p. 13-27.

Air Photo Tech Inc. (1979) Aerial topographic map of Prudhoe Bay Unit Area. Scale 1:6000, contour interval 5 foot. Prudhoe Bay Unit, Operations Subcommittee.

Alexandrova, V.D. (1970) The vegetation of the tundra zones in the USSR and data about its productivity. In *Proceedings of the Conference on Productivity and Conservation in Northern Circumpolar Lands* (W.A. Fuller and P.G. Kevan, Ed.). IUCN Publication No. 16, Morges, Switzerland, p. 93-114.

Ambronn, H. (1890) Allgemeines uber die Vegetation am Kingau-Fjord. In *Die deutschen Expeditionen und ihre Ergebnisse,* vol. 2, p. 574. Berlin. Cited in Warren Wilson (1957).

Andreev, V.N. (1966) Peculiarities of zonal distribution of the aerial and underground phytomass on the East European far north. *Botanicheskii Zhurnal,* vol. 51, p. 1401-1411. Cited in Alexandrova (1970).

Andreev, V.N. (1976) Study of the anthropogenic effects on tundra vegetation in connection with the general trend in tundra biome development. CRREL Draft Translation 557. ADA-033072.

Argus, G.W. (1973) The genus *Salix* in Alaska and the Yukon. National Museums of Canada, Publications in Botany, No. 2.

Arnell, S. (1956) *Illustrated Moss Flora of Fennoscandia. I. Hepaticae.* Lund, Sweden: CWK Gleerup.

Babb, T.A. (1973) High arctic disturbance studies. In *Botanical Studies of Natural and Man-modified Habitats in the Mackenzie Valley, Eastern Mackenzie Delta Region and the Arctic Islands* (L.C. Bliss, Ed.). ALUR report 372-73-14, Northern Economic Development Branch, Department of Indian Affairs and Northern Development, Ottawa, p. 150-162.

Babb, T.A. and L.C. Bliss (1974) Susceptibility to environmental impact in the Queen Elizabeth Islands. *Arctic,* vol. 27, no. 3, p. 234-237.

Bailey, A.M. (1948) Birds of arctic Alaska. Colorado Museum of Natural History, Popular Series No. 8.

Bamberg, S.A. and J. Major (1968) Ecology of the vegetation and soils associated with calcareous parent materials in three alpine regions of Montana. *Ecological Monographs,* vol. 38, p. 127-167.

Barnes, P.W. and D.M. Hopkins (Ed.) (1978) Geological sciences. In *Environmental Assessment of the Alaskan Continental Shelf Interim Synthesis: Beaufort/Chukchi.* Outer Continental Shelf Environmental Assessment Program, NOAA, Boulder, Co., p. 101-103.

Barrett, P.E. (1972) Phytogeocoenoses of a coastal lowland ecosystem, Devon Island, Northwest Territories. Ph.D. thesis, University of British Columbia, Vancouver.

Barrett, P.E. (1975) Preliminary observations of off-road vehicle disturbance to sedge meadow tundra at a coastal lowland location, Devon Island, Northwest Territories. ALUR 1973-74. Ottawa, Department of Indian Affairs and Northern Development.

Batten, A.R. (1977) The vascular floristics, major vegetation units, and phytogeography of the Lake Peters area, northeastern Alaska. Master's thesis, University of Alaska, Fairbanks.

Batzli, G.O., R.G. White, S.F. MacLean, Jr., F.A. Pitelka and B.D. Collier (1980) The herbivore-based trophic system. In *An Arctic Ecosystem: The Coastal Tundra at Barrow, Alaska* (J. Brown et al., Ed.). Stroudsburg, Pa.: Dowden, Hutchinson and Ross, p. 335-410.

Batzli, G.O. and H.G. Jung (1980) Nutritional ecology of microtine rodents: Resource utilization near Atkasook, Alaska. *Arctic and Alpine Research,* vol. 12, no. 4, p. 483-499.

Batzli, G.O. and S.T. Sobaski (1980) Distribution,

abundance, and foraging patterns of ground squirrels near Atkasook, Alaska. *Arctic and Alpine Research,* vol. 12, no. 4, p. 501-510.

Bee, J.W. and E.R. Hall (1956) Mammals of northern Alaska on the Arctic Slope. University of Kansas, Museum of Natural History, Miscellaneous Publication 8.

Beil, C. (1969) The plant associations of the Cariboo aspen-lodgepole pine- Douglas fir parkland zone. Ph.D. thesis, University of British Columbia, Vancouver. Cited in Barrett (1972).

Belon, A.E., J.M. Miller and W.J. Stringer (1975) Environmental assessment of resource development in the Alaskan coastal zone based on Landsat imagery. Remote-Sensing Data for OCS Studies. NOAA/OCS Project Office, Geophysical Institute, University of Alaska, Arctic Project Bulletin No. 7.

Benson, C., B. Holmgren, R. Timmer, G. Weller and S. Parrish (1975) Observations on the seasonal snow cover and radiation climate at Prudhoe Bay, Alaska, during 1972. In *Ecological Investigations of the Tundra Biome in the Prudhoe Bay Region, Alaska* (J. Brown, Ed.). Biological Papers of the University of Alaska, Special Report No. 2, p. 13-50.

Bergman, R.D. and D.V. Derksen (1977) Observations on arctic and red-throated loons at Storkersen Point, Alaska. *Arctic,* vol. 30, no. 1, p. 41-51.

Bergman, R.D., R.L. Howard, K.F. Abraham and M.W. Weller (1977) Water birds and their wetland resources in relation to oil development at Storkersen Point, Alaska. U.S. Department of Interior, Fish and Wildlife Service Resource Publication 129.

Beschel, R.E. and D. Webb (1962) Growth ring studies on arctic willows. Axel Heiberg Island preliminary report (F. Muller, Ed.). McGill University, Montreal, p. 189-198.

Bilgin, A. (1975) Nutrient status of surface waters as related to soils and other environmental factors in a tundra ecosystem. Ph.D. thesis, Rutgers University, New Brunswick, New Jersey.

Billings, W.D. and K.M. Peterson (1980) Vegetational change and ice-wedge polygons through the thaw-lake cycle in arctic Alaska. *Arctic and Alpine Research,* vol. 12, no. 4, p. 413-432.

Black, R.F. (1951) Eolian deposits of Alaska. *Arctic,* vol. 4, no. 2, p. 89-111.

Black, R.F. (1964) Gubik formation of Quaternary age in northern Alaska. U.S. Geological Survey Professional Paper 302-C, p. 59-91.

Black, R.F. (1969) Thaw depressions and thaw lakes—A review. *Biuletyn Peryglacjalny,* vol. 19, p. 131-150.

Black, R.F. and W.L. Barksdale (1949) Oriented lakes of northern Alaska. *Journal of Geology,* vol. 57, p. 105-118.

Bliss, L.C. (1975) Tundra grasslands, herblands, and shrublands and the role of herbivores. *Geoscience and Man,* vol. 10, p. 51-79.

Bliss, L.C. (1977) Vascular plants of Truelove Lowland and adjacent areas including their relative importance. In *Truelove Lowland, Devon Island, Canada: A High Arctic Ecosystem* (L.C. Bliss, Ed.). Edmonton, Alberta, Canada: University of Alberta Press, p. 693-695.

Bliss, L.C. (Ed.) (1977) *Truelove Lowland, Devon Island, Canada: A High Arctic Ecosystem.* Edmonton, Alberta, Canada: University of Alberta Press.

Bliss, L.C. (1981) A biogeographical review of tundra and mires. In *Tundra Ecosystems: A Comparative Analysis* (L.C. Bliss et al., Ed.). Cambridge, England: Cambridge University Press.

Bliss, L.C. and R.W. Wein (1972) Ecological problems associated with arctic oil and gas development. *Proceedings, Canadian Northern Pipeline Research Conference.* National Research Council of Canada, Associate Committee on Geotechnical Research, Technical Memorandum 104 (NRCC 12498), p. 65-77.

Bliss, L.C. and E.B. Peterson (1973) The ecological impact of northern petroleum development. *Proceedings of the Fifth International Congress on Arctic Oil and Gas: Problems and Possibilities.*

Bocher, T.W. (1954) Oceanic and continental vegetational complexes in southwest Greenland. *Meddelelser om Grønland,* vol. 148, p. 1-336.

Bocher, T.W. (1959) Floristic and ecological studies in Middle West Greenland. *Meddelelser om Grønland,* vol. 156, p. 1-68.

Bocher, T.W. (1963) Phytogeography of Greenland in the light of recent investigations. In *North Atlantic Biota and Their History* (A. Love and D. Love, Ed.). New York: Pergamon Press, p. 285-295.

BP Alaska, Inc. (1971) Field rules hearing testimony, Sadlerochit oil pool. Testimony given at call to public hearing with respect to Conservation Order No. 83-B, February 9, 1971.

Brady, N.C. (1974) *The Nature and Property of Soils.* New York: Macmillan.

Britton, M.E. (1967) Vegetation of the arctic tundra. In *Arctic Biology, Proceedings of the 18th*

Annual Biology Colloquium (H. Hansen, Ed.). Second Edition. Corvallis: Oregon State University Press, p. 67-130.

Britton, M.E. (Ed.) (1973) *Alaskan Arctic Tundra: Proceedings of the 25th Anniversary Celebration of the Naval Arctic Research Laboratory*. Arctic Institute of North America, Technical Paper 25.

Brower, W.A., H.F. Diaz, A.S. Prechtel, H.W. Searby and J.L. Wise (1977) *Climatic Atlas of the Outer Continental Shelf Water and Coastal Regions of Alaska*. Vol. III. *Chukchi-Beaufort Sea*. National Oceanic and Atmospheric Administration, Alaska Outer Continental Shelf Environmental Assessment Program.

Brown, J. (1965) Radiocarbon dating, Barrow, Alaska. *Arctic*, vol. 18, no. 1, p. 36-48.

Brown, J. (1966) Soils of the Okpilak River region. USA Cold Regions Research and Engineering Laboratory, CRREL Research Report 188. ADA-639691.

Brown, J. (Ed.) (1975) *Ecological Investigations of the Tundra Biome in the Prudhoe Bay Region, Alaska*. Biological Papers of the University of Alaska, Special Report No. 2.

Brown, J. and P.V. Sellmann (1973) Permafrost and coastal plain history of arctic Alaska. In *Alaskan Arctic Tundra* (M.E. Britton, Ed.). Arctic Institute of North America, Technical Paper 25, p. 31-47.

Brown, J., R.K. Haugen and S. Parrish (1975) Selected climatic and soil thermal characteristics of the Prudhoe Bay Region. In *Ecological Investigations of the Tundra Biome in the Prudhoe Bay Region, Alaska* (J. Brown, Ed.). Biological Papers of the University of Alaska, Special Report No. 2, p. 3-11.

Brown, J. and R. Berg (Ed.) (1980) Environmental engineering and ecological baseline investigations along the Yukon River-Prudhoe Bay Haul Road. USA Cold Regions Research and Engineering Laboratory, CRREL Report 80-19. ADA 094497.

Brown, J., K.R. Everett, P.J. Webber, S.F. MacLean, Jr. and D.F. Murray (1980a) The coastal tundra at Barrow. In *An Arctic Ecosystem: The Coastal Tundra at Barrow, Alaska* (J. Brown et al., Ed.). Stroudsburg, Pa.: Dowden, Hutchinson and Ross, p. 1-29.

Brown, J., P.C. Miller, L.L. Tieszen and F.L. Bunnell (Ed.) (1980b) *An Arctic Ecosystem: The Coastal Tundra at Barrow, Alaska*. Stroudsburg, Pa.: Dowden, Hutchinson and Ross.

Bruggemann, P.F. and J.A. Calder (1953) Botanical investigations in northeast Ellesmere Island, 1951. *The Canadian Field-Naturalist*, vol. 67, no. 3, p. 157-174.

Burt, G.R. (1970a) Summer travel on the tundra with low ground pressure vehicles. Institute of Arctic Environmental Engineering. University of Alaska, College, Alaska (unpubl.).

Burt, G.R. (1970b) Travel on thawed tundra. Institute of Arctic Environmental Engineering, University of Alaska, College, Alaska, Note 7005.

Cameron, R.D., K.R. Whitten, W.T. Smith and D.D. Roby (1979) Caribou distribution and group composition associated with construction of the trans-Alaska pipeline. *The Canadian Field-Naturalist*, vol. 93, no. 3, p. 155-162.

Cameron, R.D. and K.R. Whitten (1979) Seasonal movements and sexual segregation of caribou determined by aerial survey. *Journal of Wildlife Management*, vol. 43, no. 3, p. 626-633.

Canada Soil Survey Committee, Subcommittee on Soil Classification (1978) The Canadian system of soil classification. Canada Department of Agriculture, Publication 1646.

Canadian Arctic Gas Study Ltd./Alaska Arctic Gas Co. (1973-1977) *Arctic Gas Biological Report Series*. 40 volumes. Canadian Arctic Gas Study Ltd., Calgary.

Canadian Department of Indian Affairs and Northern Development, Northern Economic Development Branch, Economic Staff Group and MPS Associates (1973) Regional impact of a northern gas pipeline. Vol. 1, Summary report. Environmental-Social Committee on Northern Pipelines, Task Force on Northern Oil Development, Report No. 73-28, Information Canada, Ottawa.

Canadian Environment Protection Board (1974) Environmental impact assessment of the portion of the Mackenzie gas pipeline from Alaska to Alberta. Four volumes. Environment Protection Board, Winnipeg, Manitoba, Canada.

Cantlon, J.E. (1961) Plant cover in relation to macro-, meso-, and micro-relief. Final Report, Office of Naval Research, Grants No. ONR-208 and 216 (unpubl.).

Carlson, R.F., R. Seifert and D. Kane (1977) Effects of seasonability and variability of stream flow on nearshore coastal areas. Annual Report RU 519 OCSEAP. Arctic Project.

Carson, C.E. and K.M. Hussey (1959) The multiple-working hypothesis as applied to Alaska's oriented lakes. *Proceedings of the Iowa Academy of Science*, vol. 66, p. 334-349.

Carson, C.E. and K.M. Hussey (1962) The oriented lakes of arctic Alaska. *Journal of Geology*, vol. 70, p. 417-439.

Chapin, F.S., III (1972) Phosphate uptake by *Erio-*

phorum vaginatum. In *Proceedings, 1972 Tundra Biome Symposium,* Lake Wilderness Center, University of Washington, p. 46–50.

Chapin, F.S., III (1973) Morphological and physiological mechanisms of temperature compensation in phosphate absorption along a latitudinal gradient. Ph.D. thesis, Stanford University.

Chapin, F.S., III (1977) Temperature compensation in phosphate absorption occurring over diverse time scales. *Arctic and Alpine Research,* vol. 9, no. 2, p. 139–148.

Chapin, F.S., III (1978) Phosphate uptake and nutrient utilization by Barrow tundra vegetation. In *Vegetation and Production Ecology of an Alaskan Arctic Tundra* (L.L. Tieszen, Ed.). New York: Springer-Verlag, p. 483–507.

Chapin, F.S., III (1980) Nutrient allocation and responses to defoliation in tundra plants. *Arctic and Alpine Research,* vol. 12, no. 4, p. 553–563.

Chapin, F.S., III, K. Van Cleve and L.L. Tieszen (1975) Seasonal nutrient dynamics of tundra vegetation at Barrow, Alaska. *Arctic and Alpine Research,* vol. 7, no. 3, p. 209–226.

Chapin, F.S., III and A. Bloom (1976) Phosphate absorption: Adaptation of tundra graminoids to a low temperature, low phosphorus environment. *Oikos,* vol. 26, p. 111–121.

Chapin, F.S., III, P.C. Miller, W.D. Billings and P.I. Coyne (1980a) Carbon and nutrient budgets and their control in coastal tundra. In *An Arctic Ecosystem: The Coastal Tundra at Barrow, Alaska* (J. Brown et al., Ed.). Stroudsburg, Pa.: Dowden, Hutchinson and Ross, p. 458–482.

Chapin, F.S., III, L.L. Tieszen, M.C. Lewis, P.C. Miller and B.H. McCown (1980b) Control of tundra plant allocation patterns and growth. In *An Arctic Ecosystem, The Coastal Tundra at Barrow, Alaska* (J. Brown et al., Ed.). Stroudsburg, Pa.: Dowden, Hutchinson and Ross, p. 140–185.

Child, K.N. (1973) The reactions of barren ground caribou (*Rangifer tarandus granti*) to simulated pipeline and pipeline crossing structures at Prudhoe Bay, Alaska. Completion report, Alaska Cooperative Wildlife Research Unit.

Child, K.N. (1974) Reaction of caribou to various types of simulated pipelines at Prudhoe Bay, Alaska. *Proceedings of the Conference on Behavior of Ungulates and Its Relation to Management,* University of Calgary, Alberta, Canada, 2–5 November 1971, p. 805–812.

Child, K.N. (1975) A specific problem: The reaction of reindeer and caribou to pipelines. In *Proceedings of the First International Reindeer and Caribou Symposium.* Biological Papers of the University of Alaska, Special Report No. 1, p. 14–19.

Churchill, E.D. (1955) Phytosociological and environmental characteristics of some plant communities in the Umiat region of Alaska. *Ecology,* vol. 36, p. 606–627.

Churchill, E.D. and H.C. Hanson (1958) The concept of climax in arctic and alpine vegetation. *Botanical Review,* vol. 24, p. 127–191.

Clebsch, E.E.C. (1957) The summer season climatic and vegetational gradient between Point Barrow and Meade River, Alaska. M.S. thesis, University of Tennessee.

Clebsch, E.E.C. and R.E. Shanks (1968) Summer climatic gradients and vegetation near Barrow, Alaska. *Arctic,* vol. 21, no. 3, p. 161–171.

Clymo, R.S. (1973) The growth of *Sphagnum:* Some effects of environment. *Journal of Ecology,* vol. 61, no. 3, p. 849–869.

Colinvaux, P.A. (1967) Quaternary vegetational history of arctic Alaska. In *The Bering Land Bridge* (D.M. Hopkins, Ed.). Stanford, California: Stanford University Press, p. 207–231.

Coombe, D.E. and F. White (1951) Notes on calcicolous communities and peat formation in Norwegian Lappland. *Journal of Ecology,* vol. 49, p. 33–62.

Connors, P.G., J.P. Myers and F.A. Pitelka (1979) Seasonal habitat use by arctic Alaskan shorebirds. *Studies in Avian Biology,* vol. 2, p. 101–111.

Conover, J.H. (1960) Macro- and microclimatography of the Arctic Slope of Alaska. New England Division, U.S. Army Corps of Engineers Quartermaster Research and Engineering Center, Environmental Protection Research Division, Technical Report, EP-139.

Cooper, W.S. (1931) A third expedition to Glacier Bay, Alaska. *Ecology,* vol. 12, no. 1, p. 61–95.

Crum, H.A., W.C. Steere and L.E. Anderson (1973) A new list of mosses of North America north of Mexico. *The Bryologist,* vol. 76, no. 1, p. 85–130.

Dahl, E. (1956) Rondane: Mountain vegetation in South Norway and its relation to the environment. *Norske Videnskaps-Academi Skrifter,* vol. 1956, p. 1–394.

Degelius, G. (1955) The lichen flora on calcareous substrate in southern and central Norway. *Acta Horti Gotoburgensis,* vol. 20, p. 35–56.

Deneke, F.J., B.H. McCown, P.I. Coyne, W. Rickard and J. Brown (1975) Biological aspects of terrestrial oil spills: USA CRREL oil research in Alaska, 1970–1974. USA Cold Regions Research

and Engineering Laboratory, CRREL Research Report 346.

Dingman, S.L., R.G. Barry, G. Weller, C. Benson, E.F. LeDrew and C.W. Goodwin (1980) Climate, snow cover, microclimate and hydrology. In *An Arctic Ecosystem: The Coastal Tundra at Barrow, Alaska* (J. Brown et al., Ed.). Stroudsburg, Pa.: Dowden, Hutchinson and Ross, p. 30–65.

Divoky, G.J. (1978) Identification, documentation, and delineation of coastal migratory bird habitat in Alaska; Part I. Breeding bird use of barrier islands in the northern Chukchi and Beaufort seas; Part II. Feeding habits of birds in the Beaufort Sea. In *Environmental Assessment of the Alaskan Continental Shelf, Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. I.* Outer Continental Shelf Environmental Assessment Program, National Oceanic and Atmospheric Administration, Boulder, Colorado, p. 482–569.

Douglas, A.E. (1919–36) *Climatic Cycles and Tree Growth.* Washington, D.C.: Carnegie Institution. 3 volumes reprinted in 1971 by Verlag von J. Cramer, Codicote, Herts., Germany.

Douglas, L.A. and A. Bilgin (1975) Nutrient regimes of soils, landscapes, lakes and streams, Prudhoe Bay, Alaska. In *Ecological Investigations of the Tundra Biome in the Prudhoe Bay Region, Alaska* (J. Brown, Ed.). Biological Papers of the University of Alaska, Special Report No. 2, p. 61–70.

Drew, J.V. (1957) A pedologic study of arctic coastal plain soils near Point Barrow, Alaska. Ph.D. thesis, Rutgers University.

Drew, J.V. and R.E. Shanks (1965) Landscape relationships of soils and vegetation in the forest-tundra ecotone, Upper Firth River Valley, Alaska-Canada. *Ecological Monographs,* vol. 35, no. 3, p. 285–306.

Drew, J.V. and J.C.F. Tedrow (1957) Pedology of an arctic brown profile near Point Barrow, Alaska. *Soil Science Society of America Proceedings,* vol. 21, no. 3, p. 336–339.

Drury, W.H., Jr. (1956) *Bog Flats and Physiographic Processes in the Upper Kuskokwim River Region, Alaska* (R.C. Rollins and R.C. Roster, Ed.). Cambridge, Mass.: The Gray Herbarium of Harvard University.

Eberhardt, L.E. and W.C. Hanson (1978) Long-distance movements of arctic foxes tagged in northern Alaska. *The Canadian Field-Naturalist,* vol. 2, no. 4, p. 386–389.

Ebersole, J.J. (In prep.) Natural and disturbed vegetation in the vicinity of Oumalik Test Well No. 1. Ph.D. Thesis, University of Colorado, Boulder, Co.

Everett, K.R. (1975) Soil and landform associations at Prudhoe Bay, Alaska: A soils map of the Tundra Biome area. In *Ecological Investigations of the Tundra Biome in the Prudhoe Bay Region, Alaska* (J. Brown, Ed.). Biological Papers of the University of Alaska, Special Report No. 2, p. 53–59.

Everett, K.R. (1979) Evolution of the soil landscape in the sand region of the Arctic Coastal Plain as exemplified at Atkasook, Alaska. *Arctic,* vol. 32, no. 3, p. 207–223.

Everett, K.R. (1980a) Distribution and variability of soils near Atkasook, Alaska. *Arctic and Alpine Research,* vol. 12, no. 4, p. 433–446.

Everett, K.R. (1980b) Distribution and properties of road dust along the northern portion of the Haul Road. In *Environmental Engineering and Ecological Baseline Investigations along the Yukon River–Prudhoe Bay Haul Road* (J. Brown and R. Berg, Ed.). USA Cold Regions Research and Engineering Laboratory, CRREL Report 80-19, p. 101–128.

Everett, K.R. (1980c) Geology and permafrost. In *Geobotanical Atlas of the Prudhoe Bay Region, Alaska* (D. Walker et al., Ed.). USA Cold Regions Research and Engineering Laboratory, CRREL Report 80-14, p. 8–13.

Everett, K.R. (1980d) Landforms. In *Geobotanical Atlas of the Prudhoe Bay Region, Alaska* (D. Walker et al., Ed.). USA Cold Regions Research and Engineering Laboratory, CRREL Report 80-14, p. 14–19.

Everett, K.R. (1980e) Soils. In *Geobotanical Atlas of the Prudhoe Bay Region, Alaska* (D. Walker et al., Ed.). USA Cold Regions Research and Engineering Laboratory, CRREL Report 80-14, p. 20–23.

Everett, K.R. and R.J. Parkinson (1977) Soil and landform associations, Prudhoe Bay area, Alaska. *Arctic and Alpine Research,* vol. 9, no. 1, p. 1–19.

Everett, K.R., P.J. Webber, D.A. Walker, R.J. Parkinson and J. Brown (1978) A geoecological mapping scheme for Alaskan coastal tundra. *Proceedings, Third International Conference on Permafrost.* National Research Council of Canada, vol. 1, p. 359–365.

Feist, D.D. (1975) Population studies of lemmings in the coastal tundra of Prudhoe Bay, Alaska. In *Ecological Investigations of the Tundra Biome in the Prudhoe Bay Region, Alaska.* (J. Brown, Ed.). Biological Papers of the University of Alaska, Special Report No. 2, p. 135–143.

Fernald, M.L. (1907) The soil preferences of certain alpine and subalpine plants. *Rhodora,* vol. 9, p. 149-193.

Fredskild, B. (1961) Floristic and ecological studies near Jakobshavn, West Greenland. *Meddelelser om Grónland,* vol. 163, no. 4, p. 1-81.

Fritts, H.C. (1976) *Tree Rings and Climate.* New York: Academic Press.

Gamara, K.E. and R.A. Nunes (1976) Air quality and meteorological baseline study for Prudhoe Bay, Alaska. Report prepared for ARCO of the Prudhoe Bay Environmental Subcommittee by Metronics Associates, Inc., Palo Alto, Calif.

Gavin, A. (1973) 1972 wildlife survey, Prudhoe Bay area of Alaska. Anchorage, Alaska: Atlantic Richfield Co.

Gavin, A. (1974) *Wildlife of the North Slope, A Five Year Study, 1969-1973.* Anchorage, Alaska: Atlantic Richfield Co.

Gavin, A. (1980) *Wildlife of the North Slope, A Ten Year Study, 1969-1978.* Anchorage, Alaska: Atlantic Richfield Co.

Gersper, P.L., V. Alexander, S.A. Barkley, R.J. Barsdate and P.S. Flint (1980) The soils and their nutrients. In *An Arctic Ecosystem: The Coastal Tundra at Barrow, Alaska* (J. Brown, Ed.). Stroudsburg, Pa.: Dowden, Hutchinson and Ross, p. 219-254.

Gjaerevoll, O. (1950) The snow-bed vegetation in the surroundings of Lake Tornetrask, Swedish Lappland. *Svensk Botanisk Tidskrift,* vol. 44, p. 387-440.

Gjaerevoll, O. (1954) Kobresieto-Dryadion in Alaska. *Nytt. Mag. Bot.,* vol. 3, p. 51-54.

Gjaerevoll, O. (1956) The plant communities of the Scandinavian alpine snow-beds. *Det Kongelige Norske Videnskabers Seldkabs Skrifter,* no. 1, 405 p.

Gjaerevoll, O. (1967) Botanical investigations in central Alaska, especially in the White Mountains. Part III. Sympetalae. *Det Kongelige Norske Videnskabers Seldkabs Skrifter,* no. 10, 62 p.

Glock, W.S. (1955) Growth rings and climate. *Botanical Review,* vol. 21, p. 73-188.

Gold, L.W. and A.H. Lachenbruch (1973) Thermal conditions in permafrost. A review of the North American literature. In *Permafrost: The North American Contribution to the Second International Conference.* National Academy of Sciences, Washington, D.C., p. 3-23.

Griggs, R.F. (1934) The problem of arctic vegetation. *Journal of the Washington Academy of Sciences,* vol. 24, no. 4, p. 153-175.

Gunn, W.W. (1973) Bibliography of the Naval Arctic Research Laboratory. Arctic Institute of North America, Technical Paper No. 24.

Haag, R.W. (1974) Nutrient limitations to plant production in two tundra communities. *Canadian Journal of Botany,* vol. 52, p. 103-116.

Hale, M.E., Jr. and W.L. Culberson (1970) A fourth checklist of the lichens of the continental United States and Canada. *The Bryologist,* vol. 73, no. 3, p. 499-543.

Halliday, G. (1977) New and notable finds in the Alaskan vascular flora. *The Canadian Field-Naturalist,* vol. 91, p. 319-322.

Hamilton, T.D. and S.C. Porter (1975) Itkillik glaciation in the Brooks Range, northern Alaska. *Quaternary Research,* vol. 5, p. 471-497.

Hanson, W.C. and L.E. Eberhardt (1977) Ecological consequences of North Slope oil development. In *Biomedical and Environmental Research Program of the LASL Health Division,* January-December 1976. Los Alamos Scientific Laboratory of the University of California, Los Alamos, New Mexico, LA-6898-PR (Excerpt), p. 58-60.

Hanson, W.C. and L.E. Eberhardt (1978) Ecological consequences of petroleum development in northern Alaska. In *Biomedical and Environmental Research Program of the LASL Health Division,* January-December 1977. Los Alamos Scientific Laboratory of the University of California, Los Alamos, New Mexico, LA-7254-PR, p. 17-22.

Hanson, W.C. and L.E. Eberhardt (1979) Ecological consequences of energy resource developments in northern Alaska. Pacific Northwest Laboratory (Batelle) annual report for 1978 to the DOE Assistant Secretary for Environment; Part 2, Supplement: Ecological Sciences.

Harper, J.R. (1978) Coastal erosion rates along the Chukchi Sea coast near Barrow, Alaska. *Arctic,* vol. 31, p. 428-433.

Haugen, R.K. (1979) Climatic investigations along the Yukon River to Prudhoe Bay haul road, Alaska, 1975-78. In *Ecological Baseline Investigations Along the Yukon River-Pudhoe Bay Haul Road, Alaska* (J. Brown, Ed.). CRREL annual report to the Department of Energy.

Haugen, R.K. (1980) Regional climate. In *Environmental Engineering and Ecological Baseline Investigations along the Yukon River-Prudhoe Bay Haul Road* (J. Brown and R.L. Berg, Ed.). USA Cold Regions Research and Engineering Laboratory, CRREL Report 80-19, p. 9-20.

Haugen, R.K. and J. Brown (1980) Coastal-inland distributions of summer air temperature and precipitation in northern Alaska. *Arctic and Alpine Research,* vol. 12, no. 4, p. 403-412.

Hettinger, L., A. Janz and R.W. Wein (1973) Vegetation of the northern Yukon Territory. *Arctic Gas Biological Report Series,* vol. 1, 171 p.
Hettinger, L.R. and A.J. Janz (1974) Vegetation and soils of northeastern Alaska. *Arctic Gas Biological Report Series,* vol. 21, 206 p.
Hok, J.R. (1969) A reconnaissance of tractor trails and related phenomena on the North Slope of Alaska. U.S. Department of Interior, Bureau of Land Management.
Hopkins, D.M. (1949) Thaw lakes and thaw sinks in the Imuruk Lake area, Seward Peninsula, Alaska. *Journal of Geology,* vol. 57, p. 119–131.
Hopkins, D.M. (1967) Quaternary marine transgressions in Alaska. In *The Bering Land Bridge* (D.M. Hopkins, Ed.). Stanford, California: Stanford University Press, p. 47–90.
Hopkins, D.M. (1977) Coastal processes and coastal erosional hazards to the Cape Krusenstern archaeological site. U.S. Geological Survey Open-File Report 77-32.
Hopkins, D.M. and R.W. Hartz (1978a) Appendix to: Offshore permafrost studies, Beaufort Sea. In *Environmental Assessment of the Alaskan Continental Shelf.* Annual reports of the principal investigators for the year ending March 1978. National Oceanic and Atmospheric Administration, Environmental Research Laboratories, Boulder, Colorado.
Hopkins, D.M. and R.W. Hartz (1978b) Coastal morphology, coastal erosion, and barrier islands of the Beaufort Sea, Alaska. U.S. Geological Survey Open-File Report 78-1063.
Hopkins, D.M., K. McDougall and R.E. Nelson. (1978) The Flaxman formation of northern Alaska: Evidence for an arctic ice shelf? *American Quaternary Association, Abstracts of the Fifth Biennial Meeting,* University of Alberta, Edmonton Alberta.
Hopkins, D.M., J.V. Matthews, Jr., S.E. Schweger and S.B. Young (Ed.) (1982) *Paleoecology of Beringia.* New York: Academic Press.
Hopkins, D.M. and R.S. Sigafoos (1951) Frost action and vegetation patterns on Seward Peninsula, Alaska. U.S. Geological Survey Bulletin No. 974-C, p. 51–100.
How, G.T.S. and H. Hernandez (1975) Terrain and vegetation response to disturbance in the Yukon coastal plain and Mackenzie Delta region and relevance to the proposed gas pipeline. Environment Protection Board, Winnipeg, Canada.
Howitt, F. (1971) Permafrost geology at Prudhoe Bay. *World Petroleum,* Sept., p. 23–28.
Hultén, E. (1958) The Amphi-Atlantic plants and their phytogeographical connections. *Kungl. Svensk Vetenskapsakad Handl.,* vol. 7, p. 1–340.
Hultén, E. (1962) The circumpolar plants. *Kungl. Svensk Vetenskapsakad Handl.,* vol. 5, p. 1–275.
Hultén, E. (1968) *Flora of Alaska and Neighboring Territories: A Manual of the Vascular Plants.* Stanford, Ca.: Stanford University Press.
Hustich, I. (1948) The Scotch pine in northernmost Finland and its dependence on the climate. *Soc. Sci. Fenn. Commun. Biol.* 9.
Hustich, I. (1949) On the correlation between growth and recent climatic fluctuation. *Geografiska Annaler,* vol. 31, p. 90–105.
Hutchinson, T.C., J.A. Hellebust and M. Telford (1974) Oil spill effects on vegetation and soil microfauna at Norman Wells and Tuktoyaktuk, Northwest Territories. Environmental-Social Commission of the North. Pipelines Task Force, North Oil Development Information Canada, Ottawa, Ontario.
Hutchinson, T.C. and W. Freedman (1975) The impact of crude oil spills on arctic and sub-arctic vegetation. In *Proceedings of the Circumpolar Conference on Northern Ecology,* 15–18 September 1975, Ottawa, Canada, p. 177–182.
Ivanova, E.N. (1956) An attempt at a general soil classification. *Pochvovedenie,* vol. 3, p. 1–13. U.S. Department of Commerce Translation OTS 61-11495. Cited in Tedrow (1977).
Jensen, W.A. (1962) *Botanical Histochemistry: Principles and Practice.* San Francisco: W.H. Freeman.
Johnson, A.W., L.A. Viereck, R.E. Johnson and H. Melchior (1966) Vegetation and flora. In *Environment of the Cape Thompson Region, Alaska* (N.J. Wilimovsky and J.N. Wolfe, Ed.). U.S. Atomic Energy Commission, PNE-481, p. 277–354.
Johnson, A.W., B.M. Murray and D.F. Murray (1978) Floristics of the disturbances and neighboring locales. In *Tundra Disturbances and Recovery Following the 1949 Exploratory Drilling, Fish Creek, Northern Alaska* (D.E. Lawson et al., Ed.). USA Cold Regions Research and Engineering Laboratory, CRREL Report 78-28, p. 30–40.
Johnson, A.W. and J.G. Packer (1967) Distribution, ecology and cytology of the Ogotoruk Creek flora and the history of Beringia. In *The Bering Land Bridge* (D.M. Hopkins, Ed.). Stanford, California: Stanford University Press, p. 245-265.
Kane, D.L. and R.F. Carlson (1973) Hydrology of the central arctic river basins of Alaska. University of Alaska, Institute of Water Resources, Report No. IWR-41.
Kelso, T. (1980) Vascular flora of Cape Prince of Wales, Alaska. Unpublished manuscript.

Kessel, B. and T.J. Cade (1958) Birds of the Colville River, northern Alaska. Biological Papers of the University of Alaska No. 2, p. 1-83.

Kessel, B. and G.B. Schaller (1960) Birds of the upper Sheenjek Valley, northeastern Alaska. Biological Papers of the University of Alaska No. 4, p. 1-59.

Kihlman, A.O. (1890) Pflanzen biologischa Studien aus Russisch Lappland. *Acta Soc. Fauna Flora Fenn.* vol. 6, p. 263. Cited in Warren Wilson (1957).

Klein, D.R. (1969) The impact of oil development in Alaska. A photo essay. In *Proceedings of the Conference on Productivity and Conservation in Northern Circumpolar Lands.* IUCN Publication No. 16, p. 209-242.

Komárková, V. (1976) Alpine vegetation of the Indian Peaks area, Front Range, Colorado Rocky Mountains. Ph.D. thesis, University of Colorado, Boulder.

Komárková, V. (In prep.) Vegetation of the sand region on the Arctic Coastal Plain, Alaska. University of Colorado, Boulder.

Komárková, V. and P.J. Webber (1978) Geobotanical mapping, vegetation disturbance and recovery. In *Tundra Disturbances and Recovery Following the 1949 Exploratory Drilling, Fish Creek, Northern Alaska.* USA Cold Regions Research and Engineering Laboratory, CRREL Report 78-28, p. 41-51.

Komárková, V. and P.J. Webber (1979) Prudhoe Bay to Yukon River vegetation transect based on 5-km interval vegetation data base. USA Cold Regions Research and Engineering Laboratory, CRREL Internal Report 612.

Komárková, V. and P.J. Webber (1980) Two low arctic vegetation maps near Atkasook, Alaska. *Arctic and Alpine Research,* vol. 12, no. 4, p. 447-472.

Koppen, W. (1936) Das geographische System der Klimate. In *Handbuch der Klimatologie I.C.* (W. Koppen and Geiger, Ed.). Berlin: Borntrager.

Koranda, J.J. (1954) A phytosociological study of an uplifted marine beach ridge near Point Barrow, Alaska. M.S. thesis, Michigan State College, East Lansing.

Koranda, J.J. (1960) The plant ecology of the Franklin Bluffs area, Alaska. Ph.D. thesis, University of Tennessee, Memphis.

Kraus, G. (1874) Einege Bemerkungen uber Alter und Washstumsver haltnisse ostgronlandischer Holzgewashse. In *Die zweite deutsche Nordpolarfahrt in den Jahren 1869 und 1870.* 2, 1. Leipzig. Cited in Warren Wilson (1957).

Lachenbruch, A.H. (1959) Mechanical aspects of the contraction theory of ice wedge polygons. *Canadian Oil and Gas Industries,* vol. 12, p. 39-64. (This issue abstracts papers presented at 1st International Symposium on Arctic Geology, Calgary, January 11-13, 1960.)

Lachenbruch, A.H. (1966) Contraction theory of ice wedge polygons: A qualitative discussion. In *Proceedings, Permafrost International Conference,* Lafayette, Indiana, 11-15 November 1963. National Academy of Sciences, National Research Council Publication 1287, p. 63-71.

Lachenbruch, A.H. and B.V. Marshall (1977) Sub-sea temperatures and a simple tentative model for offshore permafrost at Prudhoe Bay, Alaska. U.S. Geological Survey Open-File Report 77-395.

LaMarche, V.C. (1974) Paleoclimatic inferences from long tree-ring records. *Science,* vol. 183, p. 1043-1048.

Lambert, J.D.H. (1968) The ecology and successional trends of tundra plant communities in the low arctic subalpine zone of the Richardson and British Mountains of the Canadian Western Arctic. Ph.D. thesis, University of British Columbia, Vancouver.

Larminie, F.G. (1976) New oil and gas provinces: North Sea and Alaska. In *Our Industry Petroleum.* London: The British Petroleum Company Limited, p. 150-172.

Lawson, D.E. and J. Brown (1978) Human-induced thermokarst at old drill sites in northern Alaska. *The Northern Engineer,* vol. 10, no. 3, p. 16-23.

Lawson, D.E., J. Brown, K.R. Everett, A.W. Johnson, V. Komárková, B.M. Murray, D.F. Murray and P.J. Webber (1978) Tundra disturbances and recovery following the 1949 exploratory drilling, Fish Creek, Northern Alaska. USA Cold Regions Research and Engineering Laboratory, CRREL Report 78-28, 91 p.

Leffingwell, E. deK. (1915) Ground-ice wedges: The dominant form of ground-ice on the north coast of Alaska. *Journal of Geology,* vol. 23, p. 635-654.

Leffingwell, E. deK. (1919) The Canning River region, northern Alaska. U.S. Geological Survey Professional Paper No. 109.

Lewellen, R.I. (1972) *Studies on the Fluvial Environment, Arctic Coastal Plain Province, Northern Alaska.* Published by the author, P.O. Box 2089, Palmer, Alaska 99645.

LGL Alaska Research Associates (1983) Prudhoe Bay Unit—Eileen West End environmental studies program, summer 1982. Prepared for Sohio Alaska Petroleum Co., Anchorage.

Livingstone, D.A. (1955) Some pollen profiles from arctic Alaska. *Ecology,* vol. 36, no. 4, p. 587–600.

McCown, B.H., F.J. Deneke, W. Rickard and L.L. Tieszen (1973) The response of Alaskan terrestrial plant communities to the presence of petroleum. In *Proceedings, Symposium on the Impact of Oil Resource Development on Northern Life, No. 1,* University of Alaska, p. 34–43.

McCulloch, D.S. (1967) Quaternary geology of the Alaskan shore of the Chukchi Sea. In *The Bering Land Bridge* (D.M. Hopkins, Ed.). Stanford, Ca.: Stanford University Press, p. 91–120.

MacCarthy, G.R. (1958) Glacial boulders on the arctic coast of Alaska. *Arctic,* vol. 11, no. 2, p. 71–85.

McFadden, T., T. Jenkins, C. Collins, L. Johnson, B. McCown and E. Sparrow (1977) Fate and effects of crude oil spilled on permafrost terrain. USA Cold Regions Research and Engineering Laboratory, CRREL Special Report 77-44.

Mackay, J.R. (1962) Pingos of the Pleistocene, Mackenzie River delta area. *Geographical Bulletin,* vol. 18, p. 21–63.

Mackay, J.R. (1963) The Mackenzie Delta area, N.W.T. Geographical Branch, Mines and Technical Surveys, Memoir 8.

Mackay, J.R. (1979) Pingos of the Tuktoyaktuk Peninsula area, Northwest Territories. *Geogr. Phys. Quat.,* vol. 33, no. 1, p. 3–61.

McKay, G.A., B.F. Findley and H.A. Thompson (1969) A climatic perspective of tundra regions. In *Proceedings of the Conference on Productivity and Conservation in Northern Circumpolar Lands,* Edmonton, Alberta, 15 to 17 October 1969 (W.A. Fuller and P.G. Kevan, Ed.). IUCN Publication N.S. 16. Morges, Switzerland: International Union for Conservation of Nature and Natural Resources, p. 10–32.

McKendrick, J.D., V.J. Ott and G.A. Mitchell (1978) Effects of nitrogen and phosphorus fertilization on carbohydrate and nutrient levels in *Dupontia fisheri* and *Arctagrostis latifolia.* In *Vegetation and Production Ecology of an Alaskan Arctic Tundra* (L.L. Tieszen, Ed.). New York: Springer-Verlag, p. 510–537.

McKendrick, J.D., G.O. Batzli, K.R. Everett and J.C. Swanson (1980) Some effects of mammalian herbivores and fertilization on tundra soils and vegetation. *Arctic and Alpine Research,* vol. 12, no. 4, p. 565–578.

Middendorf, A.T. (1867) Die Gewachse Siberiens. In *Reise in den aussersten Norden und Osten Holzgewachse,* vol. 4, p. 783. Cited in Warren Wilson (1957).

Mikola, P. (1956) Tree-ring research in Finland. *Tree-Ring Bulletin,* vol. 21, p. 16–20.

Mikola, P. (1962) Temperature and tree growth near the northern timber line. In *Tree Growth* (T. Kozlowski, Ed.). New York: Ronald Press, p. 265–274.

Miller, J.M. and T.H. George (1976) Use of satellite data in mapping ecosystems in Alaskan coastal zones. In *Proceedings, Twenty-seventh Alaska Science Conference, Fairbanks, Alaska. Vol. II—Resource Development: Processes and Problems* (D. Norton, Ed.). Alaska Division, American Association for the Advancement of Science, p. 121–132.

Morgridge, D.L. and W.B. Smith, Jr. (1972) Geology and discovery of Prudhoe Bay Field, Eastern Arctic Slope, Alaska. In *Stratigraphic Oil and Gas Fields, Classification, Exploration Methods and Case Histories.* American Association of Petroleum Geologists, Memorandum No. 16, p. 489–501.

Moritz, R.E. (1977) On a possible sea-breeze circulation near Barrow, Alaska. *Arctic and Alpine Research,* vol. 9, no. 4, p. 427–431.

Moritz, R.E. (1979) Synoptic climatology of the Beaufort Sea coast of Alaska. Institute of Arctic and Alpine Research, University of Colorado, Occasional Paper 30.

Morrissey, L.A. and R.A. Ennis (1980) Vegetation mapping of the National Petroleum Reserve-Alaska using Landsat digital data. Unpublished preliminary draft to USGS Geography Program, Reston, Virginia.

Murray, B.M. and D.F. Murray (1978) Checklists of vascular plants, bryophytes, and lichens for the Alaskan U.S. IBP Tundra Biome study areas—Barrow, Prudhoe Bay, Eagle Summit. In *Vegetation and Production Ecology of an Alaskan Arctic Tundra* (L.L. Tieszen, Ed.). New York: Springer-Verlag, p. 647–677.

Murray, D.F. (1978) Vegetation, floristics, and phytogeography of northern Alaska. In *Vegetation and Production Ecology of an Alaskan Arctic Tundra* (L.L. Tieszen, Ed.). New York: Springer-Verlag, p. 19–36.

Murray, D.F. (1980) *Threatened and Endangered Plants of Alaska.* U.S. Department of Agriculture, Forest Service and U.S. Department of Interior, Bureau of Land Management.

Murray, D.F., B.M. Murray, and A.W. Johnson (1977) Botanical reconnaissance of Yukon River-Prudhoe Bay Haul Road. USA Cold Regions Research and Engineering Laboratory, Internal Report 511.

Myers, J.P. and F.A. Pitelka (1979) Variations in

summer temperature patterns near Barrow, Alaska: Analysis and ecological interpretation. *Arctic and Alpine Research,* vol. 11, no. 3, p. 131–144.

Nie, N.H., C.H. Hull, J.G. Jenkins, K. Steinbrenner and D.H. Bent (1975) *Statistical Package for the Social Sciences.* Second edition. New York: McGraw-Hill.

Nieland, B.J. and J.R. Hok (1975) Vegetation survey of the Prudhoe Bay region. In *Ecological Investigations of the Tundra Biome in the Prudhoe Bay Region, Alaska* (J. Brown, Ed.). Biological Papers of the University of Alaska, Special Report No. 2, p. 73–78.

Norton, D.W. (1972) Effects of ACV on avian habitats. In *Preliminary Ecological Evaluation of the Effects of Air Cushion Vehicle Tests on the Arctic Tundra of Northern Alaska* (W. Rickard, Ed.). USA Cold Regions Research and Engineering Laboratory, CRREL Special Report 182, p. 21–22.

Norton, D.W., I.W. Ailes and J.A. Curatolo (1975) Ecological relationships of the inland tundra avifauna near Prudhoe Bay, Alaska. In *Ecological Investigations of the Tundra Biome in the Prudhoe Bay Region, Alaska* (J. Brown, Ed.). Biological Papers of the University of Alaska, Special Report No. 2, p. 125–133.

O'Sullivan, J.B. (1961) Quaternary geology of the arctic coastal plain, northern Alaska. Ph.D. thesis, Iowa State University, Ames.

Panshin, A.J., C. DeZeeuw and H.P. Brown (1964) *Textbook of Wood Technology.* New York: McGraw-Hill.

Parkinson, R.J. (1977) Genesis and classification of Arctic Coastal Plain soils, Prudhoe Bay, Alaska. M.S. thesis, Ohio State University, Columbus.

Parkinson, R.J. (1978) Genesis and classification of Arctic Coastal Plain soils, Prudhoe Bay, Alaska. Institute of Polar Studies, Ohio State University, Report No. 68.

Peterson, K.M. and W.D. Billings (1980) Tundra vegetational patterns and succession in relation to microtopography near Atkasook, Alaska. *Arctic and Alpine Research,* vol. 12, no. 4, p. 473–482.

Pitelka, F.A. (1957) Some characteristics of microtine cycles in the Arctic. In *Arctic Biology: Proceedings of the 18th Annual Biology Colloquium* (H.P. Hansen, Ed.). Corvallis: Oregon State University Press, p. 78–88.

Pitelka, F.A. (1973) Cycling pattern in lemming populations near Barrow, Alaska. In *Alaskan Arctic Tundra: Proceedings of the 25th Anniversary Celebration of the Naval Arctic Research Laboratory* (M.E. Britton, Ed.). Arctic Institute of North America, Technical Paper No. 25, p. 199-215.

Pitelka, F.A. (1974) An avifaunal review for the Barrow region and North Slope of arctic Alaska. *Arctic and Alpine Research,* vol. 6, no. 2, p. 161–184.

Polunin, N. (1951) The real Arctic: Suggestions for its delimitation, subdivision and characterization. *Journal of Ecology,* vol. 39, p. 308–315.

Polunin, N. (1955) Attempted dendrochronological dating of Ice Island T-3. *Science,* vol. 122, p. 1184–1186.

Polunin, N. (1959) *Circumpolar Arctic Flora.* London: Oxford University Press.

Porsild, A.E. (1938) Earth mounds in unglaciated arctic northwestern America. *Geographical Review,* vol. 28, p. 46–58.

Porsild, A.E. (1957) *Illustrated Flora of the Canadian Arctic Archipelago.* Ottawa: National Museum of Canada, Bulletin No. 146.

Racine, C.H. (1974) A report on the vegetation, lakes and streams along a proposed winter road route in the Cape Espenberg area of the Seward Peninsula, Alaska. Report to National Park Service.

Racine, C.H. (1975) Tussock tundra vegetation in relation to topography, soils and frost action in the Chukchi-Imuruk area, Seward Peninsula, Alaska. Presented to American Institute of Biological Sciences Symposium, Corvallis, Oregon.

Racine, C.H. (1977) Tundra disturbance resulting from a 1974 drilling operation in the Cape Espenberg area, Seward Peninsula, Alaska. U.S. Department of Interior, National Park Service Report.

Radforth, J.R. (1972) Analysis of disturbance effects of operations of off-road vehicles on tundra. ALUR Report No. 71-71-13. Northern Economic Development Branch, DIAND, Ottawa.

Radforth, J.R. (1973a) Immediate effects of wheeled vehicle traffic on tundra during the summer. ALUR Report No. 72-73-12. Northern Economic Development Branch, DIAND, Ottawa.

Radforth, J.R. (1973b) Long-term effects of summer traffic by tracked vehicles on tundra. ALUR Report No. 72-73-13. Northern Economic Development Branch, DIAND, Ottawa.

Rastorfer, J.R., H.J. Webster and D.K. Smith (1973) Floristic and ecologic studies of bryophytes of selected habitats at Prudhoe Bay, Alaska. Institute of Polar Studies, Ohio State University, Report No. 49.

Raup, H.M. (1941) Botanical problems in boreal America. *Botanical Review,* vol. 7, p. 147–248.

Raup, H.M. (1965) The structure and development of turf hummocks in the Mesters Vig district, Northeast Greenland. *Meddelelser om Grønland,* vol. 166, no. 3, p. 1-112.

Raup, H.M. (1968) The relation of the vascular flora to some factors of site in the Mesters Vig district, Northeast Greenland. *Meddelelser om Grønland,* vol. 176, no. 5, p. 1-80.

Rawlinson, S.E. (1983) Guidebook to permafrost and related features, Prudhoe Bay, Alaska. Preliminary guidebook, Fourth International Conference on Permafrost, 18-22 July 1983, Fairbanks, Alaska.

Rex, R.W. (1961) Hydrodynamic analysis of circulation and orientation of lakes in northern Alaska. In *Geology of the Arctic* (G.E. Raasch, Ed). Vol. II. Toronto: University of Toronto Press, p. 1021-1043.

Richardson, D.H.S. (1974) A report on the lichens at Prudhoe Bay, Alaska, U.S.A. as monitors of air quality. Unpublished manuscript, Laurentian University, Sudbury, Ontario.

Richardson, D.H.S. (1977) Lichens of Truelove Lowland. In *Truelove Lowland, Devon Island, Canada: A High Arctic Ecosystem* (L.C. Bliss, Ed.). Edmonton, Alberta, Canada: University of Alberta Press, p. 693-695.

Rickert, D.A. and J.C.F. Tedrow (1967) Pedologic investigations on some aeolian deposits of northern Alaska. *Soil Science,* vol. 104, no. 4, p. 250-262.

Rickwood, F.K. (1970) The Prudhoe Bay field. In *Geological Seminar on the North Slope of Alaska.* AAPG Pacific Sec. Seminar Proceedings, p. L1-L-11.

Rodeick, C.A. (1979) The origin, distribution, and depositional history of gravel deposits on the Beaufort Sea Continental Shelf, Alaska. U.S. Geological Survey Open-File Report 79-234.

Rogers, J.C. (1978) Meteorological factors affecting interannual variability of summertime ice extent in the Beaufort Sea. *Monthly Weather Review,* vol. 106, no. 6, p. 890-897.

Rønning, O.I. (1965) Studies on Dryadion of Svalbard. *Norsk Polarinstitutt Skrifter* 134.

Sage, B.L. (1974) Ecological distribution of birds in the Atigun and Sagavanirktok river valleys, arctic Alaska. *The Canadian Field-Naturalist,* vol. 88, no. 3, p. 281-291.

Savile D.B.O. (1964) General ecology and vascular plants of the Hazen Camp area. *Arctic,* vol. 17, no. 4, p. 237-256.

Shafer, R.V. (1979) Infra-red color photography as an environmental monitoring tool for petroleum operations in cold regions. Unpublished manuscript, Sohio-BP Alaska Production Division, Anchorage, Alaska.

Schwerdtfeger, W. (1973) Mountain barrier effect on the flow of stable air north of the Brooks Range. In *Climate of the Arctic* (G. Weller and S. Bowling, Ed.). Geophysical Institute, University of Alaska, p. 204-208.

Scriabine, R.A. (1978) U.S.-Soviet program on the protection of northern ecosystems: A commentary. *Arctic and Alpine Research,* vol. 10, no. 3, p. 553-557.

Searby, H.W. and M. Hunter (1971) Climate of the North Slope. NOAA Technical Memorandum AR-4. U.S. Department of Commerce.

Sellmann, P.V. and J. Brown (1973) Stratigraphy and diagenesis of perennially frozen sediments in the Barrow, Alaska, region. In *North American Contribution to the Second International Permafrost Conference.* Washington, D.C.: National Academy of Sciences, p. 171-181.

Sellmann, P.V., J. Brown, R.I. Lewellen, H. McKim and C. Merry (1975) The classification and geomorphic implications of thaw lakes on the Arctic Coastal Plain, Alaska. USA Cold Regions Research and Engineering Laboratory, Research Report 344.

Shapiro, L. and R. Barry (Ed.) (1978) The sea ice environment. In *Environmental Assessment of the Alaskan Continental Shelf, Interim Synthesis: Beaufort/Chukchi.* Outer Continental Shelf Environmental Assessment Program, NOAA, Boulder, Co., p. 3-55.

Sheludiakova, V.A. (1938) Rastitel'nost' bassenia reki Indigirki (The vegetation of the Indigirka River basin). *Sovetskaya Botanika,* vol. 4 and 5, p. 42-79. Translation cited in Cantlon (1961).

Shimwell, D.W. (1971) *The Description and Classification of Vegetation.* Seattle, Washington: University of Washington Press.

Sigafoos, R.S. (1952) Frost action as a primary physical factor in tundra plant communities. *Ecology,* vol. 33, p. 480-487.

Simmons, C.L., K.R. Everett, D.A. Walker, A.E. Linkins and P.J. Webber (1983) Sensitivity of plant communities and soil flora to seawater spills, Prudhoe Bay, Alaska. USA Cold Regions Research and Engineering Laboratory, CRREL Report 83-24.

Sjörs, H. (1959) Bogs and fens in the Hudson Bay lowlands. *Arctic,* vol. 12, no. 1, p. 3-19.

Skoog, R.D. (1968) Ecology of the caribou (*Rangifer tarandus granti*) in Alaska. Ph.D. thesis. University of California, Berkeley.

Smith, P.S. and J.B. Mertie (1930) Geology and mineral resources of northwestern Alaska. U.S. Geological Survey Bulletin No. 815.

Soil Survey Staff (1975) *Soil Taxonomy: A Basic System of Soil Classification for Making and Interpreting Soil Surveys.* Soil Conservation Service,

U.S. Department of Agriculture, Handbook No. 436.

Sørenson, T. (1941) Temperature relations and phenology of the Northeast Greenland flowering plants. *Meddelelser om Grønland,* vol. 125, no. 9, p. 1-305.

Spatt, P.D. (1983) *Sphagnum* at Prudhoe Bay, Alaska. *The Canadian Field-Naturalist,* vol. 97, p. 115–116.

Spatt, P.D. and M.C. Miller (1979) Effects of road dust on growth conditions and productivity of *Sphagnum* in the Alaskan Arctic. Unpublished manuscript, Department of Biological Sciences, University of Cincinnati, Cincinnati, Ohio.

Steere, W.C. (1978) Floristics, phytogeography and ecology of arctic Alaskan bryophytes. In *Vegetation and Production Ecology of an Alaskan Arctic Tundra* (L.L. Tieszen, Ed.). New York: Springer–Verlag, p. 141–167.

Steere, W.C. and H. Inoue (1978) The Hepaticae of arctic Alaska. *Journal of Hattori Botanical Laboratory,* vol. 44, p. 251–345.

Tedrow, J.C.F. (1970) Soil investigations in Inglefield Land, Greenland. *Meddelelser om Grønland,* vol. 188, no. 3, p. 1–98.

Tedrow, J.C.F. (1977) *Soils of the Polar Landscapes.* New Brunswick, N.J.: Rutgers University Press.

Tedrow, J.C.F. and J.E. Cantlon (1958) Concepts of soil formation and classification in arctic regions. *Arctic,* vol. 11, no. 3, p. 166–179.

Tedrow, J.C.F., J.V. Drew, D.E. Hill and L.A. Douglas (1958) Major genetic soils of the arctic slope of Alaska. *Journal of Soil Science,* vol. 9, p. 33–45.

Thomson, J.W. (1979) *Lichens of the Alaskan Arctic Slope.* Toronto: University of Toronto Press.

Tieszen, L.L. (1972) CO_2 exchange in the Alaskan arctic tundra: Measured cause of photosynthesis. *Proceedings, 1972 Tundra Biome Symposium,* p. 29–35.

Tieszen, L.L. (Ed.) (1978) *Vegetation and Production Ecology of an Alaskan Arctic Tundra.* New York: Springer–Verlag.

Ugolini, F.C. and J.C.F. Tedrow (1963) Soils of the Brooks Range, Alaska: 3. Rendzina of the Arctic. *Soil Science,* vol. 96, p. 121–127.

Ulrich, A., and P. Gersper (1978) Plant nutrient limitations of tundra plant growth. In *Vegetation and Production Ecology of an Alaskan Arctic Tundra* (L.L. Tieszen, Ed.). New York: Springer-Verlag, p. 457–481.

Underwood, L.S. (1975) Notes on the arctic fox (*Alopex lagopus*) in the Prudhoe Bay area of Alaska. In *Ecological Investigations of the Tundra Biome in the Prudhoe Bay Region, Alaska* (J. Brown, Ed.). Biological Papers of the University of Alaska, Special Report No. 2, p. 145–149.

Updike, R.G. and M.D. Howland (1979) Surficial geology and processes, Prudhoe Bay oilfield, Alaska, with hydrologic implications. Division of Geological and Geophysical Surveys, Anchorage, Alaska, Special Report 16.

U.S. Army Corps of Engineers (1980) Draft environmental impact statement, Prudhoe Bay Oil Field, Waterflood Project, Prudhoe Bay, Alaska. U.S. Army Corps of Engineers, Alaska District, Anchorage, Alaska.

U.S. Army Corps of Engineers (1982) Prudhoe Bay Waterflood Project environmental monitoring program 1982. Final report. U.S. Army Corps of Engineers, Alaska District, Anchorage, Alaska.

U.S. Department of Interior (1979) National Petroleum Reserve in Alaska 105 (c) Final study. Vol. 1. Summaries of values and resource analysis and land use options (excluding petroleum values and uses). NPR-A 105 (c) Planning Team, U.S. Department of Interior, Bureau of Land Management, Anchorage, Alaska.

U.S. National Oceanic and Atmospheric Administration (1979) Environmental assessment of the Alaskan continental shelf. Final reports of principal investigators. Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Viereck, L.A. and C.T. Dyrness (1980) A preliminary classfication system for vegetation of Alaska. U.S. Department of Agriculture, Forest Service Pacific Northwest Forest and Range Experiment Station, General Technical Report PNW-106.

Viereck, L.A. and E.L. Little, Jr. (1972) *Alaska Trees and Shrubs.* U.S. Forest Service, Department of Agriculture, Washington, D.C., Agriculture Handbook No. 410.

Viereck, L.A. and E.L. Little, Jr. (1975) *Atlas of United States Trees. Vol. 2. Alaska Trees and Common Shrubs.* U.S. Department of Agriculture, Forest Service, Miscellaneous Publication No. 1293.

Vigdorchik, M. (1978) A geographic based information management system for permafrost prediction in the Beaufort and Chukchi seas, Part I. Submarine permafrost on the Alaskan shelf. Final report to U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration under contract no. 3-7-022-35127.

Vigdorchik, M.E. (1980a) *Arctic Pleistocene History and the Development of Submarine Permafrost.* Boulder, Colorado: Westview Press.

Vigdorchik, M.E. (1980b) *Submarine Permafrost on the Alaskan Continental Shelf.* Boulder, Colorado: Westview Press.

Vitt, D.H. (1977) Musci of the northern lowlands of Devon Island. In *Truelove Lowland, Devon Island, Canada: A High Arctic Ecosystem* (L.C. Bliss, Ed.). Edmonton, Alberta, Canada: University of Alberta Press, p. 693-695.

Wahrhaftig, C. (1965) Physiographic divisions of Alaska. U.S. Geological Survey, Professional Paper 482.

Walker, D.A. (1977) The analysis of the effectiveness of a television scanning densitometer for indicating geobotanical features in an ice-wedge polygon complex at Barrow, Alaska. Master's thesis, University of Colorado.

Walker, D.A. (1980) Climate. In *Geobotanical Atlas of the Prudhoe Bay Region, Alaska* (D. Walker et al., Ed.). USA Cold Regions Research and Engineering Laboratory, CRREL Report 80-14, p. 10-13.

Walker, D.A. (1981) The vegetation and environmental gradients of the Prudhoe Bay region, Alaska. Ph.D. thesis, University of Colorado.

Walker, D.A. (1983) A hierarchical tundra vegetation classification especially designed for mapping in northern Alaska. In *Proceedings of the Fourth International Conference on Permafrost, 17-22 July 1983, University of Alaska, Fairbanks.* Washington, D.C.: National Academy Press, p. 1332-1337.

Walker, D.A., P.J. Webber, K.R. Everett and J. Brown (1977) The effects of low-pressure wheeled vehicles on plant communities and soils at Prudhoe Bay, Alaska. USA Cold Regions Research and Engineering Laboratory, CRREL Special Report 77-17.

Walker, D.A., P.J. Webber, K.R. Everett and J. Brown (1978) Effects of crude and diesel oil spills on plant communities at Prudhoe Bay, Alaska, and the derivation of oil spill sensitivity maps. *Arctic,* vol. 31, no. 3, p. 242-259.

Walker, D.A. and P.J. Webber (1979a) Relationships of soil acidity and air temperature to the wind and vegetation at Prudhoe Bay, Alaska. *Arctic,* vol. 32, no. 3, p. 224-236.

Walker, D.A. and P.J. Webber (1979b) Report of Yukon River to Prudhoe Bay vegetation mapping program. USA Cold Regions Research and Engineering Laboratory, CRREL Internal Report 607.

Walker, D.A., P.J. Webber and V. Komárková (1979) A large scale (1:6000) vegetation mapping method for northern Alaska. Institute of Arctic and Alpine Research, Plant Ecology Laboratory, University of Colorado.

Walker, D.A. and P.J. Webber (1980) Vegetation. In *Geobotanical Atlas of the Prudhoe Bay Region* (D.A. Walker et al., Ed.). USA Cold Regions Research and Engineering Laboratory, CRREL Report 80-14, p. 24-34.

Walker, D.A., K.R. Everett, P.J. Webber and J. Brown (1980) Geobotanical atlas of the Prudhoe Bay region, Alaska. *USA Cold Regions Research* and Engineering Laboratory, CRREL Report 80-14.

Walker, D.A., S.K. Short, J. Andrews and P.J. Webber (1981) Late Holocene pollen and present-day vegetation, Prudhoe Bay and Atigun River, Alaskan Arctic Slope. *Arctic and Alpine Research,* vol. 13, no. 2, p. 153-172.

Walker, D.A. and W. Acevedo (In prep.) A Landsat-derived vegetation map of the Beechey Point Quadrangle, Arctic Coastal Plain, Alaska. USA Cold Regions Research and Engineering Laboratory, CRREL Report.

Walker, H.J. (1973) Morphology of the North Slope. In *Alaskan Arctic Tundra* (M.E. Britton, Ed.). Arctic Institute of North America, Technical Paper No. 25, p. 49-92.

Warming, E. (1888) Om Groenlands Vegetation. *Meddelelser om Grønland,* vol. 12, p. 24. Cited in Warren Wilson (1964).

Warren Wilson, J. (1957) Observations on the temperature of arctic plants and their environment. *Journal of Ecology,* vol. 45, p. 499-531.

Warren Wilson, J. (1964) Annual growth of *Salix arctica* in the High Arctic. *Annals of Botany,* vol. 28, p. 71-76.

Washburn, A.L. (1969) Patterned ground in the Mesters Vig district, Northeast Greenland. *Biuletyn Peryglacjalny,* vol. 18, p. 259-330.

Webber, P.J. (1971) Gradient analysis of the vegetation around the Lewis Valley, north-central Baffin Island, Northwest Territories, Canada. Ph.D. thesis, Queen's University at Kingston, Canada.

Webber, P.J. (1978) Spatial and temporal variation of the vegetation and its productivity. In *Vegetation and Production Ecology of an Alaskan Arctic Tundra* (L.L. Tieszen, Ed.). New York: Springer-Verlag, p. 37-112.

Webber, P.J. and D.A. Walker (1975) Vegetation and landscape analysis at Prudhoe Bay, Alaska: A vegetation map of the Tundra Biome study area. In *Ecological Investigations of the Tundra Biome in the Prudhoe Bay Region, Alaska* (J. Brown, Ed.). Biological Papers of the University of Alaska, Special Report No. 2, p. 81-91.

Webber, P.J., V. Komárková, D.A. Walker and E. Werbe (1978) Vegetation mapping and response to disturbance along the Yukon River-

Prudhoe Bay Haul Road. USA Cold Regions Research and Engineering Laboratory, Internal Report 551.

Webber, P.J., P.C. Miller, F.S. Chapin, III and B.H. McCown (1980) The vegetation: Pattern and succession. In *An Arctic Ecosystem, The Coastal Tundra at Barrow, Alaska* (J. Brown et al., Ed.). Stroudsburg, Pa.: Dowden, Hutchinson and Ross, p. 186–218.

Werbe, E. (1980) Disturbance of a gravel highway upon Alaskan upland tundra vegetation. M.S. thesis, University of Colorado, Boulder.

West, N. (1966) Matrix cluster analysis of montane forest vegetation of the Oregon Cascades. *Ecology,* vol. 47, no. 6, p. 975–980.

White, R.G., B.R. Thomson, T. Skogland, S.J. Person, D.E. Russell, D.F. Holleman and J.R. Luick (1975) Ecology of caribou at Prudhoe Bay, Alaska. In *Ecological Investigations of the Tundra Biome in the Prudhoe Bay Region, Alaska* (J. Brown, Ed.). Biological Papers of the University of Alaska, Special Report No. 2, p. 151–201.

White, R.G. and J. Trudell (1980) Habitat preference and forage consumption by reindeer and caribou near Atkasook, Alaska. *Arctic and Alpine Research,* vol. 12, no. 4, p. 511–529.

Wiggins, I.L. (1951) The distribution of vascular plants on polygonal ground near Point Barrow, Alaska. *Contributions from the Dudley Herbarium,* vol. 4, p. 41–56.

Wiggins, I.L. and J.H. Thomas (1962) *A Flora of the Alaskan Arctic Slope.* Toronto: University of Toronto Press.

Young, S.B. (1971) The vascular flora of St. Lawrence Island with special reference to floristic zonation in the arctic regions. *Contributions from the Gray Herbarium,* vol. 201, p. 11–115.

Young, S.B. (1975) The phytogeography of the North American Arctic. Manuscript of paper presented at Symposium on Floristic Delimitation and Subdivision of the Arctic, XII International Botanical Congress, Leningrad.

APPENDIX A: ANNOTATED PLANT CHECKLIST FOR THE PRUDHOE BAY REGION

This checklist is an updated version of a list by Murray and Murray (1978). It includes notes regarding abundance, habitat and field localities. The nomenclature follows Murray and Murray (1978) except for plants that do not appear on their list. In these cases the nomenclature follows Hultén (1968) for vascular plants, Thomson (1979) and Hale and Culberson (1970) for lichens, Crum et al. (1973) for mosses and Arnell (1956) and Steere and Inoue (1978) for hepatics. First collections for the region are listed; these also are mostly from Murray and Murray (1978).

The list contains 238 vascular plants, 25 hepatics, 115 mosses, and 83 lichens. A total of 79 vascular plants, 12 hepatics, 16 mosses and 13 lichens have been added to the list as a result of this study. Starred taxa (*) have been found only west of the Kuparuk River and are therefore outside the main region discussed in this report; there are seven vascular plants, one hepatic, and one lichen that are so indicated. Double-starred taxa (**) are nine collections mentioned by Hettinger et al. (1973) from a site slightly southeast of the study area (Fig. A1) that have not been found in the main study area.

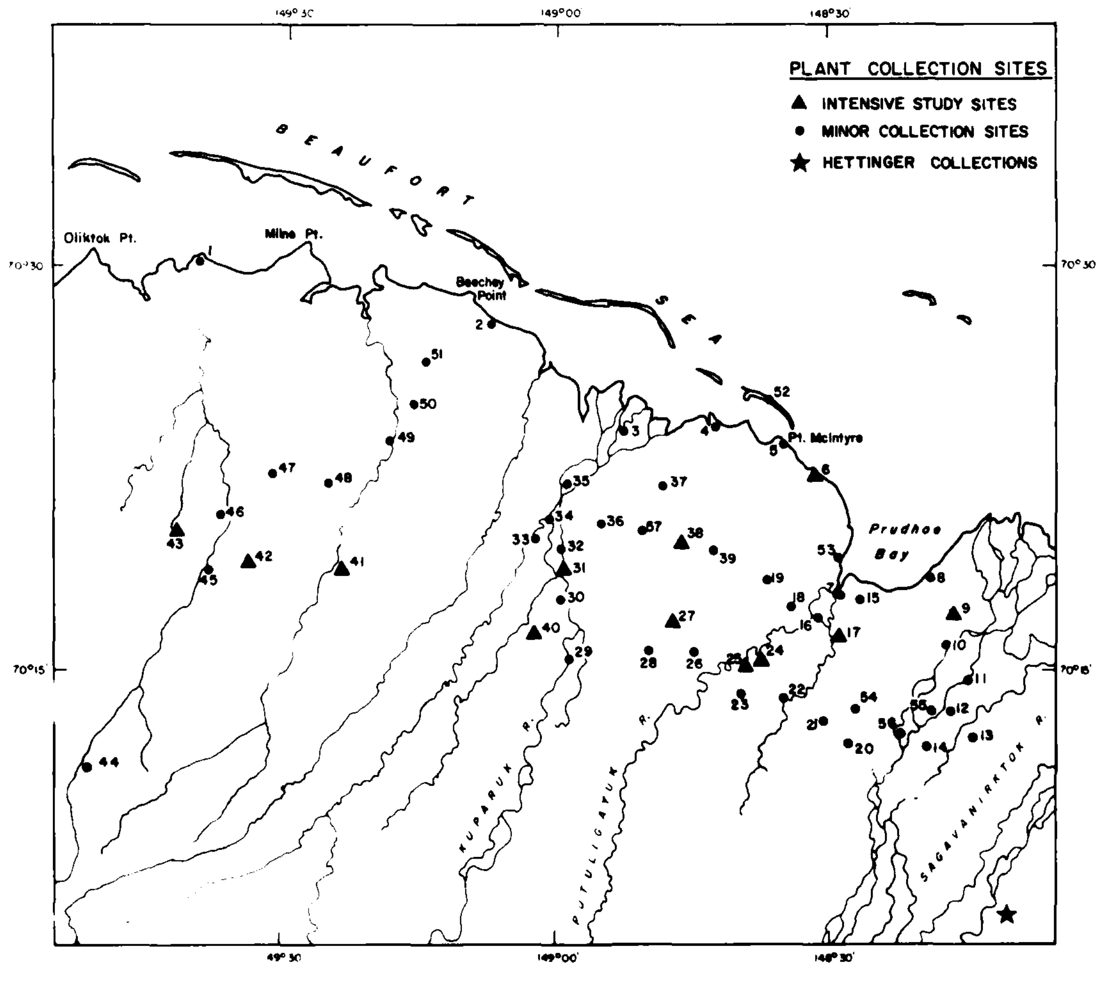


Figure A1. Locations of collection sites.

Figure A1 shows all the collection sites. This figure is referred to throughout the checklist. The abundance was rated according to the following scale:

abundant—nearly always dominant or very abundant in specified habitats
common—usually occurs with high cover percentages in specified habitats
frequent—usually occurs within small areas of specified habitats but generally not with high cover percentages
occasional—does not occur regularly in specified habitat but is also not uncommon
infrequent—recorded only a few times in the specified areas
rare—only one to three observations within the region.

Vascular plants

Achillea borealis Bong.
C. Simmons 1981. Occasional; dry river bars of the Kuparuk River.

Agropyron boreale (Turcz.) Drobov ssp. *hyperarcticum* (Pol.) Meld.
D. Murray 4575. Occasional; richly vegetated river bluffs and pingos

Alopecurus alpinus Sm. ssp. *alpinus*
D. Murray 3410. Occasional; dry to wet areas, bird mounds, acidic and alkaline areas, coast and inland.

Androsace chamaejasme Host ssp. *lehmanniana* (Spreng.) Hult.
D. Murray 3387. Frequent; dry sandy areas, dunes, riverbanks, coast and inland.

Androsace septentrionalis L.
D. Murray 4505. Occasional; well-drained sites on pingos (Figure A1, points 27, 38, 40).

Anemone parviflora Michx.
D. Murray 4531. Frequent; dry sandy soil, streambanks.

Anemone richardsonii Hook.
D. Murray 4537. Occasional; dry sandy soil, dunes and streambanks.

Antennaria friesiana (Trautv.) Ekman ssp. *alaskana* (Malte) Hult.
Murray 4571. Infrequent; dry sites, riverbanks, pingos (Figure A1, points 24, 30, 56).

Arabis lyrata L. ssp. *kamchatica* (Fisch.) Hult.
D. Murray 3359. Infrequent; sandy disturbed soil, Putuligayuk and Kuparuk rivers (Figure A1, points 25, 29, 32, 34).

Arctagrostis latifolia (R. Br.) Griseb. var. *arundinacea* (Trin.) Griseb.
P. J. Webber 1978. One specimen collected from Gas Arctic test site, fertilized berm (Figure A1, point 54); probably more common.

Arctagrostis latifolia (R. Br.) Griseb. var. *latifolia*
D. Murray 4554. Common in grassy areas, bird mounds, riverbanks; occasional in moist tundra.

Arctophila fulva (Trin.) Anderss.
D. Murray 4555. Abundant; water to 1 m deep, lakes and streams.

Arctostaphylos rubra (Rehd. and Wils.) Fern.
D. Murray 4561. Rare; dry sandy sites along rivers; common just south of region (Figure A1, points 10, 31, 34).

Armeria maritima (Mill.) Willd. ssp. *arctica* (Cham.) Hult.
D. Murray 3356. Occasional; dry stabilized dunes, riverbanks.

** *Arnica alpina* (L.) Olin.
L. Hettinger 456 (1973). Not collected in this study.

Arnica frigida C.A. Mey.
D.A. Walker and K. Palmer 80A-124. Infrequent; collected on dry river bar of Kuparuk River near Service City; also seen along the Little Putuligayuk River (Figure A1, points 17, 29, 31).

Artemisia arctica Less. ssp. *arctica*
D. Murray 4568. Occasional; dry peaty acidic tundra; frequent in river gravels and barren areas, coast and inland

Artemisia borealis Pall
Murray 3356. Common; dry sand dunes and river gravels.

Artemisia glomerata Ledeb.
D. Murray 4532. Frequent; dry sand dunes, river gravels.

Artemisia tilesii Ledeb. ssp. *tilesii*
D. Murray 4569. Occasional; river bars of Kuparuk River.

Aster sibiricus L.
D. Murray 4574. Occasional; dry sandy sites along rivers.

Astragalus aboriginorum Richards.
D.A. Walker and K. Palmer 80A-104, det. D. Murray.
Occasional; dry sites along Kuparuk River and some of its tributaries and on pingos in the Kuparuk field (Figure A1, points 28, 34, 32, 30, 40).

Astragalus alpinus L.
D. Murray 4540. Common; dry river sites, streams, pingos.

Astragalus umbellatus Bunge
D. Murray 4517. Common; dry tundra, bird mounds, shallow snow patches.

Boykinia richardsonii (Hook.) Gray
D.A. Walker 503. Infrequent; collected from coastal areas and near Kuparuk River, open tundra and snow patches (Figure A1, points 6, 31, 43).

Braya pilosa Hook.
D. Murray 3383. Frequent; disturbed areas. There is much intergradation between this taxon and *B. purpurascens*.

Braya purpurascens (R. Br.) Bunge
D. Murray 3385. Common; disturbed or unstable sites, gravel pads, river gravels, slumping riverbanks, coast and inland. There is much intergradation with *B. pilosa*. Most of my specimens best fit descriptions of *B. purpurascens*.

Bromus pumpellianus Scribn. var. *arcticus* (Shear) Pors.
D.A. Walker 570. Occasional; pingo tops, riverbanks.

** *Bupleurum triradiatum* Adams ssp. *arcticum* (Regel) Hult.
L. Hettinger 461 (1973). Not collected in this study.

Calamagrostis neglecta (Ehrh.) Gaertn., Mey. and Schreb.
D.A. Walker and K. Palmer 80A-98. Occasional; dry terraces of the Kuparuk River near Service City (Figure A1, points 29, 31).

Calamagrostis purpurascens R.Br. ssp. *arctica* (Vasey) Hult.
D.A. Walker 81-13. Occasional; dry sites, pingos, river bars.

Caltha palustris L. ssp. *arctica* (R. Br.) Hult.
D. Murray 4512. Frequent; water, streams and lake margins.

Campanula uniflora L.
D. Murray 3398. Occasional; snowbanks and pingo sides (Figure A1, points 24, 40, 41, 43).

Cardamine digitata Richards. (= *C. hyperborea* O.E. Schulz)
D. Murray 3399. Frequent; dry to moist tundra, bird mounds, frost scars, snow patches.

Cardamine pratensis L. ssp. *angustifolia* (Hook.) O.E. Schultz
D.A. Walker 549. Occasional; wet sites along streams.

Carex aquatilis Wahlenb. (including *C. stans* Drej.)
D. Murray 3586. Abundant; moist to very wet tundra throughout region.

Carex atrofusca Schkuhr
D. Murray 3370. Occasional; moist to wet alkaline tundra, mainly inland.

Carex bigelowii Torr. (including *C. lugens* Holm, *C. consimilis* Holm)
D. Murray 3416. Common; moist tundra, coast and inland.

Carex chordorrhiza Ehrh.
D.A. Walker 288, det. D. Murray. Occasional; wet to very wet acidic tundra.

* *Carex krausei* Boeck.
D.A. Walker and K. Palmer 80A-128. Only record from Ugnuravik River south of Kuparuk Camp in moist tundra (Figure A1, point 44).

Carex marina Dewey (= *C. amblyorhyncha* Krecz., Halliday and Chater 1969, *C. glareosa* sensu Hultén in part)
D.A. Walker 4, det. A. Batten. Occasional; wet tundra.

Carex maritima Gunn.
D. Murray 4514. Infrequent; sandy sites at coast and along rivers (Figure A1, points 6, 9, 31).

Carex membranacea Hook.
D.A. Walker, 5 August 1974, det. D. Murray. Common; dry to moist tundra throughout region.

Carex misandra R. Br.
B. Murray 3384. Occasional in dry to moist alkaline tundra; frequent in wet acidic and coastal tundra.

Carex nardina E. Fries
M. Walker, D.A. Walker and M. Wilson 83-122. Rare; pingos.

Carex obtusata Lilj.
M. Walker, D.A. Walker and M. Wilson 83-119. Occasional; pingos.

Carex ramenskii Kom.
M. Walker, D.A. Walker and M. Wilson 83-83. Occasional; wet saline tundra.

Carex rariflora (Wahlenb.) J.E. Sm.
D. Murray 3364. Occasional in wet tundra; frequent in acidic coastal areas.

Carex rotundata Wg.
D. Walker 154 (1975). Frequent; wet to very wet tundra.

Carex rupestris All.
D. Murray 4583. Common; dry tundra, pingos.

Carex saxatilis L. ssp. *laxa* (Trautv.) Kalela
D.A. Walker, 5 August 1974. Frequent; wet to very wet alkaline tundra.

Carex scirpoidea Michx.
D. Murray 4519. Common; dry alkaline tundra, especially snow patches.

Carex subspathacea Wormsk.
D.A. Walker and J. Batty PB039. Abundant; very wet sites in saltwater lagoons; frequent on sandy beaches.

Carex ursina Dew.
D. Murray 3406. Frequent; saltwater lagoons, slightly elevated microsites.

Carex vaginata Tausch
D.A. Walker 526. Infrequent; wet tundra (Figure A1, points 24, 25, 36, 41).

Cassiope tetragona (L.) D. Don ssp. *tetragona*
D. Murray 4539. Frequent in dry to moist tundra; abundant in well-drained snowbanks; common in some acidic tussock tundra areas in the Kuparuk field.

Castilleja caudata (Pennell) Rebr.
D.A. Walker and K. Palmer 80A-123. Occasional; dry Kuparuk River bars near Service City (Figure A1, points 29, 31).

Cerastium beeringianum Cham. and Schlecht. var. *beeringianum*
D. Murray 4538. Occasional; dry tundra, bird mounds, pingos.

Cerastium beeringianum Cham. and Schlecht. var. *grandiflorum* (Fenzl.) Hult.
D.A. Walker and K. Palmer 80A-82. Common; dry and moist tundra, bird mounds, pingos.

Cerastium jenisejense Hult.
D.A. Walker and K. Palmer 80A-180. Occasional; wet to moist tundra.

Chrysanthemum bipinnatum L. ssp. *bipinnatum*
Halliday 1977. Frequent; dry sandy sites, dunes along Kuparuk River.

Chrysanthemum integrifolium Richards.
D. Murray 3394. Frequent; moist to dry alkaline tundra, frost scars, bird mounds.

Chrysosplenium tetrandrum (Lund) Th.Fr.
D. Murray 4525. Infrequent on wet stream sides and open tundra; more common near the coast (Figure A1, points 2, 6, 24, 31, 43, 48).

Cochlearia officinalis L. ssp. *arctica* (Schlecht.) Hult.
D. Murray 4511. Common along coast, beaches, wet and moist saline tundra; occasional inland.

Colpodium vahlianum (Liebm.) Nevski
Halliday 1977. Rare; bare mud in Sagavanirktok River estuary (Halliday 1977); not recorded in this study.

Deschampsia caespitosa (L.) Beauv. ssp. *orientalis* Hult.
D. Murray 3412. Frequent; dry to moist sandy soils, rivers, dunes and coast; occasional on pingos.

Descurainia sophioides (Fisch.) O. E. Schultz
J. McKendrick, 11 September 1976. Common weed in disturbed areas.

Dodecatheon frigidum Cham. and Schlecht.
D.A. Walker 308. Rare; moist stream sides; collected near Drill Site 2 near the Little Putuligayuk River (Figure A1, point 17).

Draba alpina L.
D. Murray 3381, det. G.A. Mulligan. Note: *Draba* was poorly understood in this study. Yellow-flowered specimens were generally recorded as *D. alpina* and white-flowered specimens as *D. lactea* *D. alpina* is frequent on dry to moist tundra, pingos, bird mounds and animal dens throughout the region.

Draba cana Rydb.
D.A. Walker and K. Palmer 80A-40, det. A. Batten. Collected from Pad M vicinity.

Draba borealis DC.
D.A. Walker and K. Palmer 80A-170, det. D. Murray. Infrequent; collection from animal den on pingo near Kuparuk River (Figure A1, point 40).

Draba cinerea Adams (= *D. arctica* J. Vahl)
D. Murray 3402, det. G. A. Mulligan. See *D. alpina*.

Draba corymbosa R. Br. *ex* DC. (= *D. bellii* Holm, *D. macrocarpa* Adams, Mulligan 1974)
D. Murray 3371, det. G. A. Mulligan. See *D. alpina*.

Draba glabella Pursh (= *D. hirta* L., Mulligan 1970)
D.A. Walker 272, det. D. Murray. See *D. alpina*.

Draba lactea Adams
D. Murray 3382, det. G. A. Mulligan. See *D. alpina*.

Draba longipes Raup
D.A. Walker 241, det. D. Murray. See *D. alpina*.

Draba subcapitata Simm.
M. Walker, D.A. Walker and M. Wilson 83-52. Rare; collected from disturbed site on pingo near Pad F (Figure A1, point 38).

Dryas integrifolia M. Vahl ssp. *integrifolia*
D. Murray 4533. Abundant; moist to dry tundra, riverbanks, pingos, animal dens throughout region.

Dupontia fisheri R.Br. ssp. *fisheri*
D.A. Walker 81-95a. Infrequent; coastal meadows.

Dupontia fisheri R. Br. ssp. *psilosantha* (Rupr.) Hult.
D. Murray 4563. Abundant along coast in moist to wet sites; occasional inland.

Elymus arenarius L. ssp. *mollis* (Trin.) Hult. var.*villosissimus* (Scribn.) Hult.
D. Murray 3411. Common on dry sand dunes; occasional along streams and coast.

Epilobium davuricum Fisch. var. *arcticum* (Sam.) Polunin
Halliday 1977. Not recorded in this study.

Epilobium latifolium L.
D.A. Walker 557. Frequent on river gravels and some gravel pads.

Equisetum arvense L.
D. Murray 4515. Frequent; snowbanks and streambanks.

Equisetum scirpoides Michx.
D. Murray 3380. Frequent; late-thawing snowbanks.

Equisetum variegatum Schleich.
D. Murray 4565. Common; moist to wet tundra throughout region.

Erigeron eriocephalus J. Vahl
D. Murray 4545. Occasional; dry sandy streambanks, slumping bluffs, pingos.

Erigeron humilus Grah.
D. Murray 3378. Infrequent; grassy streambanks (Figure A1, point 31).

** *Erigeron hyperboreus* Greene
L. Hettinger 447 (1973). Not recorded in this study.

Eriophorum angustifolium Honck. ssp. *subarcticum* (Vassil.) Hult.
D.A. Walker, 5 August 1974. Abundant; moist to wet tundra throughout region.

Eriophorum callitrix Cham.
D.A. Walker 327, det. D. Murray. Wet tundra near Drill Site 2 (Figure A1, point 17).

Eriophorum russeolum Fr.
D.A. Walker 291. Frequent; wet to very wet tundra throughout region.

Eriophorum scheuchzeri Hoppe var. *scheuchzeri*
D. Murray 3405. Occasional; very wet tundra throughout region.

Eriophorum triste (Th. Fr.) Hadac and Love (= *E. angustifolium* ssp. *triste*)
D. Murray 3375. *E. triste* was not differentiated from *E. angustifolium* in the quadrat data (Appendix B), since it infrequently flowers. It is, however, abundant on moist tundra sites throughout the region.

Eriophorum vaginatum L.
D. Murray 4550. Occasional on moist tundra sites; frequent on better drained upland sites, especially inland; less common near the coast.

** *Eritrichum aretioides* (Cham.) DC.
L. Hettinger 452 (1973). Not recorded in this study.

** *Erysimum pallasii* (Pursh) Fern.
L. Hettinger 466 (1973). Not recorded in this study.

Eutrema edwardsii R. Br.
D. Murray 3368. Occasional; dry to moist mostly alkaline tundra.

Festuca baffinensis Polunin
D. Murray 3417. Common on grassy riverbanks, bird mounds, animal dens; occasional on dry tundra sites.

Festuca brachyphylla Schult.
D. Murray 4564. Common; grassy riverbanks, bird mounds.

** *Festuca ovina* L. ssp. *alaskensis* Holmen
L. Hettinger 450B (1973). Not recorded in this study.

Festuca rubra L.
D. Murray 3415. Frequent; pingo tops, bird mounds, grassy riverbanks and gravel bars.

Gentiana prostrata Haenke
D. Murray 4556. Infrequent along the Kuparuk River.

Gentianella propinqua (Richards.) J. M. Gillett ssp. *propinqua* (= *Gentiana propinqua*)
D. Murray 3407. Occasional; dry to moist streambanks.

Hedysarum alpinum L. ssp. *americanum* (Michx.) Fedsch.
D.A. Walker and K. Palmer 80A-101. Occasional along the Kuparuk River; common farther south.

Hedysarum mackenzii Richards.
D.A. Walker and K. Palmer 80A-133, det A. Batten. One record collected from the Sagavanirktok River near Drill Site 19. Probably more common along rivers in the southern part of the region.

Hierochloe alpina (Sw.) Roem. and Schult.
D.A. Walker and K. Palmer s.r. 1980. One record from dry pingo side of Beechey Mound (Figure A1, point 51). Probably more common.

Hierochloe pauciflora R. Br.
D.A. Walker 1. Occasional; mainly wet tundra along coast.

Hippuris tetraphylla L. F.
J.P. Myers 1976. Rare; one collection from pond near coast.

Hippuris vulgaris L.
D. Murray 4552. Common; deeper water, mainly streams.

Honckenya peploides (L.) Ehrh. ssp. *peploides*
D.A. Walker and K. Palmer 80A-75. Occasional along gravelly or sandy coastal beaches; collected at Point McIntyre and near Beechey Point.

Juncus arcticus Willd. ssp. *alaskanus* Hult.
D. Murray 4553. Frequent; wet sites, mainly in river sands and gravels.

Juncus biglumis L.
D. Murray 4560. Occasional on moist to wet tundra; frequent on frost scars.

Juncus castaneus Sm. ssp. *castaneus*
D. Murray 3404. Infrequent; streambanks, grassy areas and gravel river bars (Figure A1, points 31, 56).

Juncus castaneus Sm. ssp. *leucochlamys* (Zinz.) Hult.
P.J. Webber 1978, det. D. A. Walker. Rare; collected from Gas Arctic test site, grassy revegetated berm (Figure A1, point 54).

Juncus triglumis L. ssp. *albescens* (Lange) Hult.
D.A. Walker and J. Batty, August 1974. Infrequent on wet tundra, apparently more common in vicinity of the Kuparuk River.

Kobresia myosuroides (Vill.) Fiori and Paol.
D. Murray 4557. Occasional; dry sandy sites along rivers, dunes.

Kobresia sibirica Turcz.
D. Murray 3352. Infrequent; grassy animal dens, pingos (Figure A1, points 31, 40, 41).

Koenigia islandica L.
D. Murray and Johnson 6207. Occasional; wet disturbed sites, frost scars.

Lagotis glauca Gaertn. ssp. *minor* (Willd.) Hult.
D. Murray 4526. Occasional; moist alkaline tundra and along streams.

* *Ledum palustre* L. ssp. *decumbens* (Ait.) Hult.
D.A. Walker 1979. Recorded west of the Kuparuk River in moist acidic tundra (Figure A1, points 42 and 43); common south of the region.

Lesquerella arctica (Wormsk.) Wats. ssp. *arctica*
D. Murray 3395. Occasional; dry sites, pingos, gravel bars.

Lloydia serotina (L.) Rchb.
D. Murray 3390. Frequent; dry sites, dunes, pingos, riverbanks, animal dens, snowbanks.

Lupinus arcticus S. Wats.
D.A. Walker and K. Palmer 80A-110. Occasional on dry river terraces of Kuparuk River near Service City; common a little farther south (Figure A1, points 29, 31).

Luzula arctica Blytt
D. Murray 4580. Frequent on moist and dry sites near coast; occasional inland.

Luzula confusa Lindeb.
D. A. Walker 285. Occasional; dry grassy tundra, pingo tops, bird mounds, animal dens.

Luzula kjellmaniana Miyabe and Kuds (= *L. tundricola* Gorodk.)
D.A. Walker 256 (1975). Infrequent; bird mounds, pingo tops; recorded near coast and Pad F (Figure A1, points 6, 38).

* *Luzula multiflora* (Retz) Lej.
D.A. Walker and K. Palmer 80A-86. Only record from bird mound near the Ugnuravik River in the Kuparuk field (Figure A1, point 45); probably more common.

* *Lycopodium selago* L. ssp. *appressum* (Desv.) Hult.
D.A. Walker and K. Palmer 80A-156. Two records from moist acidic tundra near Pad A in the Kuparuk field (Figure A1, point 43).

Mertensia maritima (L.) S. F. Gray ssp. *maritima*
D. A. Walker and K. Palmer 80A-165. Occasional along gravelly or sandy coastal beaches; collected at Point McIntyre and near Beechey Point (Figure A1, points 2, 5, 52).

Minuartia arctica (Stev.) Ashers. and Graebn.
D. Murray 3379. Frequent; dry tundra, pingos, streambanks, snowbanks, animal dens.

Minuartia rossii (R. Br.) Graebn.
A. E. Schofield and M. E. Williams P-G16. Occasional; dry sites (Figure A1, points 36, 43).

Minuartia rubella (Wahlenb.) Graebn.
D. Murray 3403. Infrequent; pingos, dry sites along rivers, common on frost scars, particularly in the Kuparuk field (Figure A1, points 24, 31, 38).

Orthilia secunda (L.) House ssp. *obtusata* (Turcz.) Bocher (= *Pyrola secunda* ssp. *obtusata*)
D. A. Walker and J. Batty PB005. One collection from moist tundra (Figure A1, point 24).

Oxyria digyna (L.) Hill
D. Murray 4520. Occasional; snowbanks along unstable river bluffs and in some sandy dune areas.

Oxytropis arctica R. Br.
D. Murray 3396. Occasional; dry sites.

Oxytropis borealis DC.
D. Murray 4559. Infrequent; dry sites on river terraces; common farther south (Figure A1, points 40, 56).

Oxytropis campestris L. DC. ssp. *gracilis* (Nels.) Hult.
D. A. Walker and K. Palmer 80A-41. Infrequent on dry Kuparuk River bars near Service City and Pad R; more common farther south (Figure A1, points 34, 32).

Oxytropis campestris L. DC. ssp. *jordalli* (Pors.) Hult.
D. A. Walker and K. Palmer 80A-60, det. D. Murray. Occasional on dry river bars and pingos

along the Kuparuk River. Specimens from Prudhoe Bay are similar to those collected from near Franklin Bluffs.† They do not match the type specimens for *O. campestris jordalli* but are placed here for lack of a better name at this time.

Oxytropis deflexa (Pall.) DC. var. *foliolosa* (Hook.) Barneby
D. Murray 4584. Occasional; dry sites on river terraces and pingos (Figure A1, points 40, 56).

Oxytropis koyukukensis Pors.
M. Walker, D.A. Walker and M. Wilson 83-42. Pingos and dry river terraces; this is an uncertain determination and may be confused with other species of *Oxytropis* in this study.

Oxytropis maydelliana Trautv.
D. Murray 4513. Frequent; pingos, grassy riverbanks.

Oxytropis nigrescens (Pall.) Fisch. ssp. *bryophila* (Greene) Hult.
D. Murray 4541. Common on dry sites, pingos, ridges, river bars, stabilized dunes; not so common west of the Kuparuk River.

Papaver lapponicum (Tolm.) Nordh. ssp. *occidentale* (Lundstr.) Knaben
D. Murray 4521. Occasional; dry sites, pingos, stable dunes.

Papaver macounii Greene
D. Murray 3377. Frequent; dry to moist tundra, bird mounds, animal dens, pingos.

Parnassia kotzebuei Cham. & Schlecht.
D. Murray 4570. Occasional; dry grassy river terraces, sandy creek banks, some dunes.

Parnassia palustris L. ssp. *neogaea* (Fern.) Hult.
L. Klinger 81-01. Occasional; Kuparuk River and its small tributaries.

Parrya nudicaulis (L.) Regel. ssp. *nudicaulis*
D. Murray 3408. Frequent on moist sandy sites along streams and snowbanks; occasional on open tundra.

Parrya nudicaulis (L.) Regel ssp. *septentrionalis* Hult.
L. Hettinger 444 (1973). Occasional; mixed with ssp. *nudicaulis.*

Pedicularis capitata Adams.
D. Murray 3386. Frequent on dry tundra, pingos, bird mounds, animal dens, river terraces; occasional on moist tundra.

Pedicularis hirsuta L.
Halliday 1977. Not collected in this study.

Pedicularis lanata Cham. and Schlecht. (= *P. kanei* Durand)
D. Murray 3556. Frequent; moist to dry tundra, pingos, bird mounds.

Pedicularis langsdorffii Fisch. ssp. *arctica* (R. Br.) Pennell
D. Murray 3362. Infrequent; drier sites, dunes and dry terraces (Figure A1, points 9, 31).

Pedicularis sudetica Willd. ssp. *albolabiata*
D. Murray 3372. Frequent; wet areas throughout region.

Pedicularis sudetica Willd. ssp. *interior* Hult.
D. Murray 3391. Frequent on moist tundra. This includes a distinctive *Pedicularis* that occurs in dry areas, dunes and coastal bluffs and that does not really fit the descriptions of *P. sudetica*, but it is placed here for lack of a better name.

† Personal communication with D. Murray, University of Alaska, 1980.

Pedicularis verticillata L.
D.A. Walker and K. Palmer 80A-105. Occasional; dry river bars, Kuparuk River near Pad R and Service City.

Petasites frigidus (L.) Franch.
D. Murray 4582. Infrequent east of Kuparuk River; more common to the west (Figure A1, points 1, 38, 43, 48).

Phippsia algida (Soland.) R. Br.
Halliday 1977. Infrequent; wet bare soil in coastal region and snowbanks.

Phlox sibirica L. ssp. *siberica*
D.A. Walker 81-12. Rare; collected from Kuparuk River 2 km south of Service City.

Pleuropogon sabinei R. Br.
Halliday 1977. Rare; along a few streams in the Kuparuk field and in wet sites near Gathering Center 3.

Poa alpigena (Fr.) Lindm.
D. Murray 4576. Occasional; pingos, bird mounds, grassy terraces.

Poa alpina L.
M. Walker, D.A. Walker and M. Wilson 83-248. Occasional; pingos and dry grassy areas.

Poa arctica R. Br.
D.A. Walker 330, det. D. Murray. Frequent; drier sites along coast, bird mounds and pingos inland.

Poa glauca M. Vahl
D. Murray 3419. Frequent; pingo tops, grassy riverbanks, animal dens.

Poa malacantha Kom.
P.J. Webber 1979, det. Walker. Infrequent; bird mounds (Figure A1, points 38, 54).

Poa pratensis L.
L. Hettinger 454 (1973). Frequent; pingo summits, bird mounds and animal dens.

Polemonium acutiflorum Willd.
Halliday 1977. Occasional on grassy river terraces of the Kuparuk River; common farther south.

Polemonium boreale Adams
D. Murray 3353. Frequent; dunes, pingos, riverbanks.

Polygonum bistorta L. ssp. *plumosum* (Small) Hult. [= *Bistorta plumosa* (Small) Greene]
D.A. Walker 528. Frequent in moist acidic tundra west of the Kuparuk River; infrequent east of the river; rare in alkaline tundra (Figure A1, points 42, 43, 45, 48, 57).

Polygonum viviparum L. [= *Bistorta vivipara* (L.) S. F. Gray]
D. Murray 3389. Frequent; dry to moist tundra throughout region.

Potentilla biflora Willd.
D.A. Walker 81-14. Rare; Kuparuk River 2 km south of Service City.

Potentilla hookeriana Lehm. ssp. *hookeriana*
D. Murray 3401. Occasional; pingo tops, grassy river terraces, bird mounds.

Potentilla hyparctica Malte
D.A. Walker and K. Palmer 80A-62. Frequent; pingo tops, bird mounds, animal dens (Figure A1, point 36).

* *Potentilla palustris* (L.) Scop.
D.A. Walker and K. Palmer s.r. 1980. Plot 7-9a. Rare; Kuparuk field, wet streamside tundra (Figure A1, point 47). Collected in 1981 in an oxbow of the Kuparuk River.

Potentilla pulchella R. Br.
D. Murray 3358. Frequent; dry sites near coast.

Potentilla uniflora Ledeb.
D. Murray 4529. Occasional; dry pingo tops, dunes, bird mounds.

Primula borealis Duby
D. Murray 4510. Frequent; dry sites near coast.

Primula egaliksensis Wormsk.
D.A. Walker 81-14. Occasional; willow-covered river bars south of Service City.

Puccinellia andersonii Swallen
D. Murray 3414, ver. A. E. Porsild. Common; coastal beaches and disturbed sites inland.

Puccinellia angustata (R. Br.) Rand and Redf.
Halliday 1977. Infrequent; coastal beaches (Halliday 1977). Not recorded in this study.

Puccinellia phryganodes (Trin.) Scribn. and Merr.
D. Murray 4567. Abundant in estuaries and saltwater lagoons; frequent on partially vegetated beaches.

Pyrola grandiflora Radius
D.A. Walker 545. Infrequent in moist tundra east of Kuparuk River; more common in acidic tussock tundra in Kuparuk field.

Ranunculus gmelinii DC. ssp. *gmelinii*
D.A. Walker and K. Palmer 80A-153. Infrequent; bare wet mud (Figure A1, points 21, 40).

Ranunculus hyperboreus Rottb. ssp. *hyperboreus*
Halliday 1977. Infrequent; brackish ponds along the coast.

Ranunculus nivalis L.
D. Murray 3555. Occasional; riverbanks, snowbanks.

Ranunculus pallasii Schlecht.
Halliday 1977. Infrequent; very wet tundra (Figure A1, points 20, 38, 43).

Ranunculus pedatifidus Sm. ssp. *affinis* (R. Br.) Hult.
D. Murray 4536. Frequent; grassy pingo tops.

* *Ranunculus pygmaeus* Wahlenb. ssp. *pygmaeus*
M. Walker, D.A. Walker and M. Wilson 83-269. Rare, collected from snowbank of large pingo in the Eileen West End area.

Ranunculus trichophyllus Chaix. ssp. *eradicatus* (Laest.) Cook (= *R. aquatilis* L. var. *eradicatus*)
D.A. Walker 532. Rare; small stream near Flow Station 3 (Figure A1, point 24).

* *Rubus chamaemorus* L.
D.A. Walker 1979. Specimen from west of Kuparuk River; not found east of the river (Figure A1, point 42).

Sagina intermedia Fenzl
D. Murray 4562. Infrequent; dry river gravels, pingos.

Salix alaxensis (Anderss.) Cov. var. *alaxensis*
D. Murray 4566. Occasional along Kuparuk River near Service City and Sagavanirktok River near Drill Site 9; common farther south.

Salix arctica Pall.
D. Murray 4523. Common; moist tundra throughout region.

** *Salix arctophila* Cockerell
L. Hettinger 477 (1973). Not recorded in this study.

Salix brachycarpa Nutt. ssp. *niphoclada* (Rydb.) Argus
L. Hettinger 429 (1973). Occasional along the Kuparuk River near Service City; common farther south.

Salix glauca L.
L. Hettinger 445 (1973). Occasional along the Kuparuk River near Service City; abundant farther south.

Salix lanata L. ssp. *richardsonii* (Hook.) A. Skvortz.
D. Murray 3351. Frequent in moist tundra in alkaline region; abundant along some streams inland.

Salix ovalifolia Trautv. var. *ovalifolia*
D. Murray 3366. Common; in dunes, along rivers, and at coast.

Salix phlebophylla Anderss.
D.A. Walker and K. Palmer 80A-163. Only collection from dry exposed site on Beechey Mound in Kuparuk field (Figure A1, point 51). Probably more common.

Salix planifolia Pursh ssp. *pulchra* (Cham.) Argus var. *pulchra*
D. Murray 4522. Rare in alkaline tundra; common in moist acidic tundra and at coast.

Salix reticulata L. ssp. *reticulata*
D. Murray 4534. Common; dry to moist tundra, snowbanks.

Salix rotundifolia Trautv. ssp. *rotundifolia*
D. Murray 4548. Common; along streams, snowbanks, and dry high-centered polygons.

** *Salix sphenophylla* A. Skvortz.
L. Hettinger 432, 436 (1973). Not recorded in this study.

Saussurea angustifolia (Willd.) DC.
D.A. Walker 555. Frequent; dry to moist tundra.

** *Saxifraga bronchialis* L. ssp. *funstonii* (Small) Hult.
L. Hettinger 468 (1973). Not recorded in this study.

Saxifraga caespitosa L.
D. Murray 4546. Occasional; pingo tops, animal dens.

Saxifraga cernua L.
D. Murray 4547. Frequent along coast, moist to wet tundra.

Saxifraga foliolosa
D.A. Walker 1980. Frequent in wet acidic tundra; rare in alkaline areas.

Saxifraga hieracifolia Waldst. and Kit.
D. Murray 4543. Occasional; grassy river terraces, wet stream sides, pingo tops, bird mounds.

Saxifraga hirculus L.
D. Murray 3369. Frequent; wet to moist tundra, bird mounds, pingos.

Saxifraga nelsoniana D. Don (= *S. punctata* L. ssp. *nelsoniana*)
D.A. Walker and K. Palmer 80A-102. Occasional; moist to wet, mainly acidic tundra.

Saxifraga oppositifolia L. ssp. *oppositifolia*
D. Murray 4524. Common; dry tundra, pingos, frost scars, mainly alkaline tundra.

Saxifraga rivularis L. (including *S. hyperborea* R. Br.)
Halliday 1977. Infrequent; snowbanks and wet areas.

Saxifraga tricuspidata Rottb.
D. Murray 4544. Infrequent; pingo tops (Figure A1, points 38, 40).

Sedum rosea (L.) Scop. ssp. *integrifolium* (Raf.) Hult.
D. Murray 3354. Occasional; sand dunes, dry coastal bluffs, river bars.

Senecio atropurpureus (Ledeb.) Fedtsch. ssp. *frigidus* (Richards.) Hult.
D. Murray 3365. Frequent; moist to dry tundra.

Senecio congestus (R. Br.) DC.
D.A. Walker, July 1974. Frequent; disturbed sites (Figure A1, points 5, 20, 21). This plant appears to be spreading rapidly in disturbed sites throughout the region. It was very uncommon in the early 1970s.

Senecio hyperborealis Greenm.
D.A. Walker and K. Palmer 80A-132. Occasional; dry river bars of Kuparuk River (Figure A1, point 29).

Senecio lugens Richards.
D.A. Walker 81-14. Occasional; pingos and river bars.

Senecio resedifolius Less.
D. Murray 3376. Occasional; well-drained riverbanks.

Silene acaulis L.
D. Murray 4535. Frequent; dry tundra, high-centered polygons, snow patches, riverbanks.

Silene involucrata (Cham. and Schlecht.) Bocq. (= *Melandrium affine* J. Vahl)
D. Murray 3373. Occasional; dry grassy pingo tops and streambanks (Figure A1, points 20, 38).

Silene wahlbergella Chawd. ssp. *arctica* (Fr.) Hult. [= *S. uralensis* (Rupr.) Bocquet
= *Melandrium apetalum* (L.) Fenzl]
D. Murray 3363. Occasional; moist to wet tundra.

Sparganium hyperboreum Laest.
D.A. Walker and K. Palmer 80A-131. Infrequent; ponds and streams; recorded near Deadhorse and two streams near the Kuparuk River (Figure A1, points 20, 36, 40).

Stellaria edwardsii R. Br.
D.A. Walker and K. Palmer, 80A-53. Collection from dry coastal bluff of the Putuligayuk River (Figure A1, point 53). Probably occasional.

Stellaria humifusa Rottb.
D.A. Walker and J. Batty PB037. Common; coastal beaches and wet saline areas.

Stellaria laeta Richards.
D. Murray 4549. Frequent; dry tundra, pingo tops, bird mounds.

Taraxacum ceratophorum (Ledeb.) DC.
D. Murray 3355. Occasional; grassy pingo tops, riverbanks (Figure A1, points 10, 11, 30, 31, 32, 34).

Taraxacum phymatocarpum J. Vahl
D. Murray 3397. Occasional; pingo tops, riverbanks, animal dens (Figure A1, points 27, 38).

Thalictrum alpinum L.
D. Murray 3392. Occasional; wet streambanks (Figure A1, points 31, 32, 34).

Thlaspi arcticum Pors.
D. Murray 4530. Occasional, along Kuparuk River gravel terraces and dunes (Figure A1, points 31, 32, 34). It has not been found elsewhere in the region. This is one of two known sites for this plant in Alaska and is listed as a threatened plant (Murray 1980).

Tofieldia pusilla (Michx.) Pors.
D.A. Walker and J. Batty PB028. Infrequent; moist tundra (Figure A1, points 24, 31, 38).

Trisetum spicatum (L.) Richter
D. Murray 3413. Occasional; dry sites, pingos, dunes, river terraces.

Utricularia vulgaris L. ssp. *macrorhiza* (Le Conte) Clausen
D.A. Walker, 5 August 1974, det. D. Murray. Occasional; water to 1 m deep.

* *Vaccinium uliginosum* L. ssp. *microphyllum* Lange
D.A. Walker 1979. Recorded west of Kuparuk River in moist acidic tundra; occurs mainly in snow-protected areas; common to the south.

Vaccinium vitis-idaea L. ssp. *minus* (Lodd.) Hult.
D.A. Walker 277. Infrequent east of Kuparuk River, mainly in acidic tundra; more common west of the river (Figure A1, points 6, 38, 42, 43, 48).

Valeriana capitata Pall.
D. Murray 4551. Occasional; moist to wet stream sides.

Wilhelmsia physodes (Fisch.) McNeill
D. Murray 4528. Occasional; moist gravel bars.

Hepatics†

Anastrophyllum minutum (Schreb.) Schust.
D.A. Walker 49(020A-9). Frequent; moist acidic tundra intermixed with *Dicranum* spp.

Aneura pinguis (L.) Dum. (= *Riccardia pinguis*)
Rastorfer, Webster and Smith 1973. Frequent; dry to wet tundra.

Arnellia fennica (Gott.) Lindb.
D.A. Walker 52, det. W. C. Steere. Collected from moist tundra; IBP area (Figure A1, point 24).

† Annotations for the bryophytes and lichens should be regarded in light of the author's limited experience with these groups and the difficulty of identifying many taxa in the field.

Blepharostoma trichophyllum (L.) Dum.
Rastorfer, Webster and Smith 1973. Frequent; dry to moist tundra.

Calypogeia muelleriana (Schiffn.) K. Mull.
D.A. Walker 82(030B-2). One collection from moist tundra near Angel Pingo (Figure A1, point 27).

Cephaloziella arctica Bryhn and Douin
Rastorfer, Webster and Smith 1973. Not recorded in this study.

* *Chandonanthus setiformis* (Ehrh.) Lindb.
D.A. Walker and K. Palmer s.r. 1980. Plot K-1 near Kuparuk Camp; occasional; moist tussock tundra.

Chiloscyphus polyanthus (L.) Corda
D.A. Walker 94. Collected from wet lake margin near Pad F (Figure A1, point 38).

Clevea hyalina (Sommerf.) Lindb.
B. Murray 6215, det. W. C. Steere. Not recorded in this study.

Gymnocolea inflata (Huds.) Dum.
D.A. Walker 1405-9, det. W.C. Steere. Two records from moist tundra polygon rims near Pad F (Figure A1, point 38).

Harpanthus flotowianus Nees
D.A. Walker 72 (030A-11), det. W.C. Steere. Collected from moist polygon rim in IBP area (Figure A1, point 24).

Lophozia binsteadii (Kaal.) Evans
D.A. Walker 1403, det. W.C. Steere. Two records from moist polygon rims near Pad F (Figure A1, point 38).

Lophozia heterocolpa (Thed.) Howe
D.A. Walker 21 (1311-12), det. W.C. Steere. Collected from moist strangmoor ridge near Pad F (Figure A1, point 38).

Lophozia quadriloba (Lindb.) Evans
D.A. Walker 1403-6, det. W.C. Steere. Collected from moist tundra near Pad F (Figure A1, point 38).

Marchantia alpestris Nees
B. Murray 4417, det. K. Damsholt. Occasional in disturbed sites.

Marchantia polymorpha L.
B. Murray 4428. Common; disturbed peaty soil throughout region.

Mesoptychia sahlbergii (Lindb. and Arn.) Evans
W.C. Steere 72-700a(NY). Frequent; moist tundra (Steere and Inoue 1978).

Odontoschisma macounii (Aust.) Und.
Rastorfer, Webster and Smith 1973. Not recorded in this study.

Plagiochila arctica Bryhn and Kaal.
D.A. Walker 71, det. W. C. Steere. Frequent; dry to moist tundra.

Preissia quadrata (Scop.) Nees
B. Murray 6243. Not recorded in this study.

Ptilidium ciliare (Web.) Hampe
Rastorfer, Webster and Smith 1973. Common in some areas of moist tundra, especially near Pad F.

Radula prolifera H. Arnell
Rastorfer, Webster and Smith 1973. Frequent; moist tundra.

Scapania irrigua (Nees) Dum.
Rastorfer, Webster and Smith 1973. Not recorded in this study.

Scapania simmonsii Bryhn and Kaal.
D.A. Walker 1403, det. W.C. Steere. Frequent; moist tundra near Pad F (Figure A1, point 38).

Tritomaria quinquedentata (Huds.) Buch
Rastorfer, Webster and Smith 1973. Not recorded in this study.

Mosses

Aloina brevirostris (Hook. and Grev.) Kindb.
B. Murray 6231. Not recorded in this study.

Aplodon wormskjoldii (Hornem.) R. Br. (= *Haplodon wormskjoldii*)
Rastorfer, Webster and Smith 1973. Occasional; on caribou feces.

Aulacomnium acuminatum (Lindb. and Arnell) Kindb.
Rastorfer, Webster and Smith 1973. Occasional; dry to moist tundra; often misidentified as *A. palustre* in this study.

Aulacomnium palustre (Hedw.) Schwaegr.
Rastorfer, Webster and Smith 1973. Common; moist to dry tundra.

Aulacomnium turgidum (Wahlenb.) Schwaegr.
Rastorfer, Webster and Smith 1973. Common; mesic and dry tundra.

Barbula icmadophila Schimp. *ex* C. Muell.
Rastorfer, Webster and Smith 1973. Not recorded in this study.

Brachythecium groenlandicum (C. Jens.) Schljak
D.A. Walker 15(1311-4), det. W.C. Steere. Two records from moist tundra, Drill Site 2 and coast. Species of *Brachythecium* and other members of the Brachytheceaceae were often not differentiated and were recorded as "Brachyth ;eaceae" in this study.

Brachythecium turgidum (C. J. Hartm.) Kindb.
Rastorfer, Webster and Smith 1973. Not recorded in this study. See *B. groenlandicum*.

Bryobrittonia longipes (Mitt.) Horton (= *B. pellucida*)
B. Murray 6247. Occasional; moist to dry tundra.

Bryoerythrophyllum recurvirostrum (Hedw.) Chen (= *Didymodon recurvirostris*)
Rastorfer, Webster and Smith 1973. Not recorded in this study.

Bryum algovicum Sendtm.
D.A. Walker 66(030A-5), det. W. Steere. Collected from moist tundra in IBP area. Only in rare cases was *Bryum* given a species designation.

Bryum arcticum (R. Br.) B.S.G.
Rastorfer, Webster and Smith 1973. Not recorded in this study. See *B. algovicum*.

Bryum argenteum Hedw.
B. Murray 6249. Frequent; bare soil, disturbed area. See *B. algovicum*.

Bryum cf. *caespiticium* Hedw.
D.A. Walker 24, det. W C. Steere. Collected from dry high-centered polygons in IBP area. See *B. algovicum*.

Bryum calophyllum R. Br.
Rastorfer, Webster and Smith 1973; Steere, written communication, 1977. Not recorded in this study. See *B. algovicum*.

Bryum cryophilum Mart. (= *B. obtusifolium*)
B. Murray 6248. Not recorded in this study. See *B. algovicum*.

Bryum pallescens Schleich. *ex* Schwaegr.
Rastorfer, Webster and Smith 1973. Not recorded in this study. See *B. algovicum*.

Bryum pendulum (Hornsch.) Schimp.
W.C. Steere, written communication to B. Murray 1977. Not recorded in this study. See *B. algovicum*.

Bryum pseudotriquetrum (Hedw.) Gaertn., Meyer and Scherb.
D.A. Walker 25(1311-17), det. W.C. Steere. Collected from moist tundra, coastal area. See *B. algovicum*.

Bryum stenotrichum C. Muell. (= *B. inclinatum*)
Rastorfer, Webster and Smith 1973. Frequent; dry to wet tundra. See *B. algovicum*.

Bryum tortifolium Funck
D.A. Walker 32(1306-2), det. W.C. Steere. Collected from wet tundra, coastal area. See *B. algovicum*.

Bryum wrightii Sull. and Lesq.
W.C. Steere and B. Murray 1974. Occasional on frost scars and disturbed tundra.

Calliergon giganteum (Schimp.) Kindb.
W.C. Steere 72-718(NY). Occasional; deeper water, streams and oxbow ponds.

Calliergon orbicularicordatum (Ren. & Card.) Broth.
W.C. Steere 72-665(NY). Not recorded in this study.

Calliergon richardsonii (Mitt.) Kindb. *ex* Warnst.
Rastorfer, Webster and Smith 1973; var. *robustum* (Lindb. and Arn.) Broth em. Kar. Abundant in wet to very wet tundra, dunes and Kuparuk River areas; frequent elsewhere.

Calliergon sarmentosum (Wahlenb.) Kindb.
Rastorfer, Webster and Smith 1973. Not recorded in this study.

Calliergon trifarium (Web. and Mohr) Kindb.
W.C. Steere, written communication to B. Murray, 1974. Not recorded in this study.

Campylium stellatum (Hedw.) C. Jens.
Rastorfer, Webster and Smith 1973; var. *arcticum* (Williams) Sav.-Ljub. (= *C. arcticum*). Abundant in wet tundra at coast; frequent in a variety of habitats.

Catoscopium nigritum (Hedw.) Brid.
Rastorfer, Webster and Smith 1973. Frequent; moist to wet alkaline tundra. Not recorded in acidic areas.

Ceratodon purpureus (Hedw.) Brid.
Rastorfer, Webster and Smith 1973. Frequent; moist to wet tundra primarily in disturbed areas.

Cinclidium arcticum (B.S.G.) Schimp.
Rastorfer, Webster and Smith 1973. Frequent; moist and wet tundra.

Cinclidium latifolium Lindb.
Rastorfer, Webster and Smith 1973. Common in wet tundra in dunes and Kuparuk River areas; frequent in wet tundra, especially in alkaline areas.

Cirriphyllum cirrosum (Schwaegr. *ex* Schultes) Grout
Rastorfer, Webster and Smith 1973. Common; moist tundra. Often recorded as Brachytheceaceae in this study.

Cratoneuron arcticum Steere
D.A. Walker 49, det. W. C. Steere. Frequent; dry to moist tundra.

Cratoneuron filicinum (Hedw.) Spruce
W.C. Steere 72-739(NY). Not recorded in this study.

Ctenidium molluscum (Hedw.) Mitt.
D.A. Walker 29, det. W.C. Steere. Collected from moist tussock tundra near Angel Pingo (Figure A1, point 27).

Cyrtomnium hymenophylloides (Heub.) Kop.
Rastorfer, Webster and Smith 1973. Collected from moist tundra near Pad F (Figure A1, point 38).

Desmatodon heimii (Hedw.) Mitt. (= *Pottia heimii*)
B. Murray 4472. Collected from disturbed tundra around drill site, West Dock (Figure A1, point 6).

Desmatodon latifolius (Hedw.) Brid.
Steere, written communication to B. Murray, 1977. Not recorded in this study.

Desmatodon leucostoma (R. Br.) Berggr. (= *D. suberectus*)
Rastorfer, Webster and Smith 1973. Not recorded in this study.

Dicranella crispa (Hedw.) Schimp. (= *Anisothecium crispum*)
Rastorfer, Webster and Smith 1973. Collected from animal den near Pad F (Figure A1, point 38).

Dicranum angustum Lindb.
Rastorfer, Webster and Smith 1973. Common; moist to dry acidic tundra.

Dicranum elongatum Schleich. *ex* Schwaegr.
Rastorfer, Webster and Smith 1973. Common; moist to dry acidic tundra.

Didymodon asperifolius (Mitt.) Crum, Steere and Anderson
B. Murray 4446. Occasional; moist alkaline tundra, especially bordering streams.

Distichium capillaceum (Hedw.) B.S.G.
Rastorfer, Webster and Smith 1973. Abundant in dry to moist alkaline tundra; common in moist to wet tundra throughout region.

Distichium hagenii Ryan *ex* Philib.
Rastorfer, Webster and Smith 1973. Not recorded in this study.

Distichium inclinatum (Hedw.) B.S.G.
Rastorfer, Webster and Smith 1973. Occasional; dry to moist tundra.

Ditrichum flexicaule (Schwaegr.) Hampe
Rastorfer, Webster and Smith 1973. Abundant; dry to moist tundra.

Drepanocladus brevifolius (Lindb.) Warnst. (= *D. lycopodioides* var. *brevifolius*)
W.C. Steere 72-731. Abundant; wet to moist alkaline tundra throughout region.

Drepanocladus exannulatus (B.S.G.) Warnst. (= *D. purpurascens*)
W.C. Steere and Z. Iwatsuki 74-317(NY). Not recorded in this study.

Drepanocladus revolvens (Sw.) Warnst.
Rastorfer, Webster and Smith 1973. Infrequent; wet tundra.

Drepanocladus uncinatus (Hedw.) Warnst.
Rastorfer, Webster and Smith 28, det. B. Murray. Common; moist to dry tundra.

Encalypta alpina Sm.
W.C. Steere 72-707(NY). Frequent; moist to dry tundra. This and other species of *Encalypta* were often recorded as *Encalypta* sp. in this study.

Encalypta mutica Hag.
B. Murray 6244. Frequent; moist to dry tundra. See *E. alpina.*

Encalypta procera Bruch
Rastorfer, Webster and Smith 1973. Frequent; dry tundra. See *E. alpina.*

Encalypta rhaptocarpa Schwaegr. (= *E. vulgaris* var. *rhaptocarpa*)
Rastorfer, Webster and Smith 1973. Frequent; dry tundra. See *E. alpina.*

Eurhynchium pulchellum (Hedw.) Jenn.
D.A. Walker 1403-11, det. B. Murray. Collected in moist tundra near Pad F (Figure A1, point 38).

Fissidens adiantoides Hedw.
W.C. Steere and Z. Iwatsuki 74-318(NY). Not recorded in this study.

Fissidens osmundoides Hedw.
Rastorfer, Webster and Smith 1973. Occasional; moist to wet tundra.

Funaria arctica (Berggr.) Kindb. (= *F. hygrometrica* var. *arctica, F. microstoma* var. *obtusifolia*)
B. Murray 6251. Occasional; disturbed soil, bird mounds, animal dens.

Funaria polaris Bryhn
Rastorfer, Webster and Smith 1973. Not recorded in this study.

Grimmia apocarpa Hedw. (= *Schistidium apocarpum*)
Battrum 304. Not recorded in this study.

Hylocomium splendens (Hedw.) B.S.G. var. *obtusifolium* (Geh.) Par. (= *H. alaskanum*)
Rastorfer, Webster and Smith 1973. Occasional; moist acidic tundra.

Hypnum bambergeri Schimp.
Rastorfer, Webster and Smith 1973. Common; moist tundra mainly in alkaline areas.

Hypnum cupressiforme Hedw.
Rastorfer, Webster and Smith 1973. Frequent; dry tundra.

Hypnum procerrimum Mol.
B. Murray 4440. Common; dry tundra.

Hypnum revolutum (Mitt.) Lindb.
D.A. Walker 55, det. W.C. Steere. Occasional; moist tundra.

Hypnum vaucheri Lesq.
Rastorfer, Webster and Smith 1973. Not recorded in this study.

Leptobryum pyriforme (Hedw.) Wils.
B. Murray 4412. Common; disturbed areas, bare soil, bird mounds.

Meesia triquetra (Richt.) Ångstr.
Rastorfer, Webster and Smith 1973. Common in wet alkaline tundra near Sagavanirktok River dunes and Kuparuk River; frequent in other alkaline areas.

Meesia uliginosa Hedw.
Rastorfer, Webster and Smith 1973. Frequent; moist to wet tundra mainly in alkaline areas.

Mnium andrewsianum Steere (= *Rhizomnium andrewsianum*) (Steere) Kop.
W.C. Steere, written communication to B. Murray 1974. Rare; wet tundra (Figure A1, point 6).

Mnium blyttii B.S.G.
B. Murray 4426. Frequent; moist to wet tundra. Usually recorded as *Mnium* sp. in this study.

Mnium rugicum Laur. (= *Plagiomnium ellipticum* [Brid.] Kop. = *P. rugicum* [Laur.] Kop.)
Rastorfer, Webster and Smith 1973. Collected from wet coastal area (Figure A1, point 6). Probably common and recorded as *Mnium* sp.

Mnium thomsonii Schimp. (= *M. orthorrhynchum*)
W.C. Steere 72-683(NY). Not recorded in this study.

Myurella julacea (Schwaegr.) B.S.G.
Rastorfer, Webster and Smith 1973. Collected from moist tundra in IBP area.

Myurella tenerrima (Brid.) Lindb.
Rastorfer, Webster and Smith 1973. Not recorded in this study.

Oncophorus wahlenbergii Brid.
Rastorfer, Webster and Smith 1973. Frequent; moist to wet, mainly acidic tundra.

Orthothecium chryseum (Schwaegr. *ex* Schultes) B.S.G.
Rastorfer, Webster and Smith 1973. Frequent; moist to wet tundra.

Orthothecium intricatum (C. J. Hartm.) B.S.G.
B. Murray 6234, det. W.C. Steere. Not recorded in this study.

Orthothecium rufescens (Brid.) B.S.G.
W.C. Steere 72-715(NY). Not recorded in this study.

Orthothecium strictum Lor.
W.C. Steere, written communication to B. Murray, 1977. Not recorded in this study.

Philonotis fontana (Hedw.) Brid. var. *pumila* (Turn.) Brid. (= *P. tomentella*)
W.C. Steere 72-679(NY). Occasional; wet tundra.

Plagiopus oederiana (Sw.) Limpr.
D.A. Walker 1403-13, det. B. Murray. Collected from moist tundra near Pad F (Figure A1, point 38).

Platydictya jungermannoides (Brid.) Crum (= *Amblystegiella jungermannoides*)
D.A. Walker 51, det. W.C. Steere. Collected from moist tundra in IBP area (Figure A1, point 24).

Pohlia cruda (Hedw.) Lindb.
Rastorfer, Webster and Smith 1973. Frequent; moist tundra throughout region. Recorded as *Pohlia* sp. in this study.

Pohlia nutans (Hedw.) Lindb.
D.A. Walker 78(1305-4), det. W. Steere. Frequent; moist tundra. Recorded as *Pohlia* sp. in this study.

Polytrichastrum alpinum (Hedw.) G.L. Smith [= *Pogonatum alpinum* (Hedw.) Roehl. var. *septentrionale* (Brid.)]
Rastorfer, Webster and Smith 1973. Frequent in moist to dry acidic tundra; rare in alkaline areas. Often recorded as Polytrichaceae in this study.

Polytrichum commune Hedw. var. *nigrescens* Warnst. (= *P. swartzii*)
D.A. Walker, 1403-8, det. B. Murray. Frequent; dry to moist acidic tundra. Recorded as Polytrichaceae in this study.

Rhacomitrium lanuginosum (Hedw.) Brid.
Rastorfer, Webster and Smith 1973. Occasional; moist tundra, bird mounds, frost scars.

Rhytidium rugosum (Hedw.) Kindb.
Rastorfer, Webster and Smith 1973. Common; dry to moist tundra, pingos.

Scorpidium scorpioides (Hedw.) Limpr.
Rastorfer, Webster and Smith 1973. Abundant; very wet to wet tundra and water up to 1 m deep.

Scorpidium turgescens (T. Jens.) Loeske (= *Calliergon turgescens*)
Rastorfer, Webster and Smith 1973. Collected in wet to moist tundra in IBP area and near Drill Site 2 (Figure A1, points 16, 24).

Sphagnum fimbriatum Wils.
P. Spatt 1981. Rare; collected from two sites near West Dock in moist acidic tundra.

Sphagnum girgensohnii Russ
P. Spatt 1981. Rare; collected near the West Dock in moist acidic tundra.

Splachnum sphaericum Hedw.
Rastorfer, Webster and Smith 1973. Not recorded in this study.

Splachnum vasculosum Hedw.
B. Murray 4415. Occasional; on caribou feces, in wet areas.

Stegonia latifolia (Schwaegr. *ex* Schultes) Vent. *ex* Broth. var. *pilifera* (Brid.) Broth.
B. Murray 6246. Collected from frost scar near Pad F (Figure A1, point 38).

Tayloria acuminata Hornsch.
B. Murray 6249. Not recorded in this study.

Tayloria lingulata (Dicks.) Lindb.
W.C. Steere, written communication to B. Murray, 1977. Not recorded in this study.

Tetraplodon mnioides (Hedw.) B.S.G.
B. Murray 4448. Occasional; on caribou feces, moist to wet areas.

Tetraplodon pallidus Hag.
W.C. Steere, written communication to B. Murray, 1977. Not recorded in this study.

Tetraplodon paradoxus (R. Br.) Hag.
W.C. Steere, written communication to B. Murray, 1977. Not recorded in this study.

Thuidium abietinum (Hedw.) B.S.G. (= *Abietinella abietina*)
Rastorfer, Webster and Smith 1973. Common; dry tundra, snow patches, bird mounds.

Timmia austriaca Hedw.
B. Murray 4431, det. V. B. Lauridsen. Frequent; dry to moist tundra, bird mounds. This and other species of *Timmia* were often recorded as *Timmia* sp.

Timmia megapolitana Hedw. var. *bavarica* (Hessl.) Brid.
B. Murray 6235. Collected from very wet tundra near Drill Site 2. See *T. austriaca.*

Timmia norvegica Zett.
Rastorfer, Webster and Smith 1973. Collected from snow patch near Angel Pingo. See *T. austriaca.*

Tomenthypnum nitens (Hedw.) Loeske (= *Homalothecium nitens*)
Rastorfer, Webster and Smith 1973. Abundant; moist tundra.

Tortella arctica (Arn.) Crundw. and Nyh.
Rastorfer, Webster and Smith 68, det. B. Murray. Frequent; dry to moist tundra.

Tortella fragilis (Drumm.) Limpr.
B. Murray 6242. Not recorded in this study.

Tortula mucronifolia Schwaegr.
B. Murray 6250. Not recorded in this study.

Tortula ruralis (Hedw.) Gaertn., Meyer and Scherb.
Rastorfer, Webster and Smith 1973. Common; dry to moist tundra, bird mounds.

Trichostomum arcticum Kaal. (= *T. cuspidatissimum*)
D.A. Walker 20 July 1974, det. B. Murray. Collected from moist tundra in IBP area (Figure A1, point 24).

Voitia hyperborea Grev. and Arnott
Rastorfer, Webster and Smith 1973, as *V. nivalis* Hornsch; Steere 1974. Collected from moist tundra in IBP area (Figure A1, point 24).

Lichens

Alectoria nigricans (Ach.) Nyl.
E.A. Schofield Ak-86, det. M.E. Williams. Frequent; dry tundra, particularly in acidic areas.

Alectoria ochroleuca (Hoffm.) Mass.
B. Murray 6219. Occasional; dry tundra.

Asahinea chrysantha (Tuck.) W. Culb. and C. Culb.
M.E. Williams Ak-652, det. B. Murray. Infrequent; snowbank areas.

Buellia alboatra (Hoffm.) Branth. and Rostr.
Battrum 325A (UAC), det. C.D. Bird. Not recorded in this study.

Buellia papillata (Somm.) Tuck.
B. Murray 4355, det. J.W. Thomson. Not recorded in this study.

Buellia punctata (Hoffm.) Mass.
D.A. Walker 75-332, det. J.W. Thomson. Collected on dry wood, coastal strand line (Figure A1, point 6).

Caloplaca cinnamomea (Th. Fr.) Oliv.
B. Murray 6245, det. J.W. Thomson. Note: *Caloplaca* was not differentiated to species in this study. The genus is nearly always present on dry to moist sites on dead plant material or animal droppings.

Caloplaca discolor (Will.) Fink
B. Murray 6227, det. J.W. Thomson. See *C. cinnamomea.*

Caloplaca holocarpa (Hoffm.) Wade
B. Murray, cited in Thomson (1979). See *C. cinnamomea.*

Caloplaca stillicidiorum (Vahl) Lynge
B. Murray 6245, det. J.W. Thomson. See *C. cinnamomea.*

Caloplaca tiroliensis Zahlbr.
D.A. Walker 2(010A-4), det. J.W. Thomson. Collected on dry plant material, high-centered polygons in IBP area.

Candelariella aurella (Hoffm.) Zahlbr.
B. Murray 6228, det. J.W. Thomson. Not recorded in this study.

Candelariella xanthostigma (Pers.) Lett.
B. Murray 6241, det. J.W. Thomson. Not recorded in this study.

Cetraria cucullata (Bell.) Ach.
B. Murray 4331. Common; dry to moist tundra, snowbanks.

Cetraria delisei (Bory *ex* Schaer.) Th. Fr.
B. Murray 4345. Frequent; snowbanks.

Cetraria islandica (L.) Ach.
B. Murray 4335. Common; dry to moist tundra.

Cetraria nivalis (L.) Ach.
B. Murray 4330. Frequent; dry to moist tundra, snowbanks.

Cetraria richardsonii Hook.
B. Murray 4332. Frequent; dry to moist tundra, snowbanks.

Cetraria tilesii Ach.
B. Murray 4349. Occasional; dry to moist tundra, pingos.

* *Cladina rangiferina* (L.) Harm. (= *Cladonia rangiferina*)
D.A. Walker 1979. Specimen from west of Kuparuk River (Figure A1, point 42); not recorded east of the river.

Cladonia amaurocraea (Floerke) Schaer.
M.E. Williams Ak-655, det. J.W. Thomson. Infrequent; moist tundra. It was recorded as *Cladonia* sp. in this study.

Cladonia gracilis (L.) Willd. var. *gracilis*
D.A. Walker 74(1405-10), det. J.W. Thomson. Frequent; particularly in moist acidic tundra.

Cladonia lepidota Nyl.
D.H.S. Richardson (ALA 61969), det. J.W. Thomson. Collected from dry peaty polygon rim near coast (Figure A1, point 6).

Cladonia phyllophora Hoffm.
D.A. Walker 3(1310-1), det. J.W. Thomson. Infrequent; two records from coastal area (Figure A1, point 6).

Cladonia pocillum (Ach.) O. Rich.
B. Murray 4350. Frequent; moist to dry tundra.

Cladonia squamosa (Scop.) Hoffm.
E.A. Schofield Ak-91, det. M.E. Williams. Recorded on wet tundra near Pad F and at coast (Figure A1, points 6, 38).

Cladonia subfurcata (Nyl.) Arn.
E.A. Schofield Ak-90, det. J.W. Thomson. Not recorded in this study.

Collema bachmanianum (Fink) Degel. (= *C. tenax* var. *bachmanianum*)
B. Murray 4328, det. J.W. Thomson; var. *milligranum* Degel. *Collemas* were recorded as *Collema* sp. and not differentiated to species in this study.

Collema tuniforme (Ach.) Ach. em. Degel.
B. Murray 4342, det. J.W. Thomson. See *Collema bachmanianum.*

Cornicularia aculeata (Schreb.) Ach.
B. Murray 4326. Not recorded in this study.

Cornicularia divergens Ach.
B. Murray 6237. Frequent; dry tundra, mainly acidic soils.

Dactylina arctica (Hook.) Nyl.
B. Murray 4333. Frequent; moist to dry tundra, snowbanks.

Dactylina ramulosa (Hook.) Tuck.
B. Murray 4329. Occasional; moist tundra, snowbanks.

Evernia perfragilis Llano
B. Murray 4344, det. J.W. Thomson. Frequent; dry tundra.

Fulgensia bracteata (Hoffm.) Raes.
B. Murray 4363. Recorded on dry saline soils on coastal bluffs affected by recent storm surges (Figure A1, points 8, 53); also on pingos and dry tundra.

Gyalecta foveolaris (Ach.) Schaer.
B. Murray 4364, det. J.W. Thomson. Infrequent; moist tundra.

Hypogymnia physodes (L.) W. Wats.
B. Murray 4400, det. J.W. Thomson, esorediate. Not recorded in this study. See *H. subobscura.*

Hypogymnia subobscura (Vain.) Poelt
B. Murray 4327. Frequent; dry soil. Some records of this may be *H. physodes.*

Lecanora beringii Nyl.
D.H.S. Richardson (ALA 61974), det. J.W. Thomson. Not recorded in this study.

Lecanora epibryon (Ach.) Ach.
B. Murray 4337. Common on soil, dry tundra, frost scars; frequent in moist tundra on dead plant material.

Lecanora verrucosa Ach.
B. Murray 4339. Not recorded in this study.

Lecidea assimilata Nyl.
D.H.S. Richardson (ALA 61975), det. J.W. Thomson. Not recorded in this study.

Lecidea ramulosa Th. Fr.
D.A. Walker 10(WD-2), 75-333, det. J.W. Thomson. Occasional; wet acidic tundra, particularly at coast.

Lecidea vernalis (L.) Ach.
B. Murray 4361, det. J.W. Thomson. Occasional; dry tundra.

Lepraria membranacea (Dicks.) Vain.
B. Murray 6240, det. J.W. Thomson. Not recorded in this study.

Leptogium sinuatum (Huds.) Mass.
D.A. Walker 75-370, det. J.W. Thomson. Collected from rim of low-centered polygon in IBP area (Figure A1, point 24).

Leptogium tenuissimum (Dicks.) Fr.
B. Murray 4347, det. J.W. Thomson. Not recorded in this study.

Lopadium fecundum Th. Fr.
B. Murray 4396, det. J.W. Thomson. This collection is the first record of this species for Alaska (Thomson 1979).

Ochrolechia frigida (Sw.) Lynge f. *thelephoroides* (Ach.) Lynge
B. Murray 4395, det. J.W. Thomson. The fruticose form *thelephoroides* is particularly abundant on moist strangmoor features in the acidic tundra areas. At the coast and elsewhere this species is more commonly crustose.

Ochrolechia upsaliensis (L.) Mass.
B. Murray 4360, det. J.W. Thomson. Not recorded in this study.

Parmelia omphalodes (L.) Ach.
B. Murray 4392. Not recorded in this study.

Parmeliella praetermissa (Nyl.) P. James
D.H.S. Richardson (ALA 61971), det. J.W. Thomson. Not recorded in this study.

Peltigera aphthosa (L.) Willd.
B. Murray 4397. Frequent; moist tundra.

Peltigera canina (L.) Willd.
B. Murray 4382. Frequent; moist to dry tundra. *P. rufescens* and *P. spuria* were recorded as *P. canina* in this study.

Peltigera malacea (Ach.) Funck
B. Murray 4325, det. J.W. Thomson. Infrequent; moist to dry tundra.

Peltigera polydactyla (Neck.) Hoffm.
D.H.S. Richardson (ALA 61970), det. B. Murray. Not recorded in this study.

Peltigera rufescens (Weis.) Humb. (= *P. canina* var. *rufescens*)
B. Murray 4374, det. J.W. Thomson. See *P. canina*.

Peltigera spuria (Ach.) DC. (= *P. canina* var. *spuria*) f. *sorediata* Schaer.
B. Murray 4340, det. J.W. Thomson. See *P. canina*.

Pertusaria dactylina (Ach.) Nyl.
D.A. Walker 11, det. J.W. Thomson. Occasional; dry tundra, pingos.

Pertusaria octomela (Norm.) Erichs.
B. Murray 4394. Not recorded in this study.

Pertusaria panyrga (Ach.) Mass.
B. Murray 4358, det. J.W. Thomson. Not recorded in this study.

Pertusaria subobducens Nyl.
B. Murray 4338, det. J.W. Thomson. Collected from very dry windblown site on Prudhoe Mound (Figure A1, point 17).

Physcia dubia (Hoffm.) Lett.
B. Murray 6218. Not recorded in this study.

Physconia muscigena (Ach.) Poelt (= *Physcia muscigena*)
B. Murray 4348. Frequent; dry sites.

Polyblastia bryophila Lonnr.
B. Murray 6227, det. J.W. Thomson. This is apparently the first record of this species for Alaska. Not recorded in this study.

Polyblastia sendtneri Kremph.
B. Murray 4386, det. J.W. Thomson. Not recorded in this study.

Psoroma hypnorum (Vahl) S. Gray
D.A. Walker 75(1403-1), det. J.W. Thomson. Occasional; moist acidic tundra and animal dens.

Ramalina almquistii Vain.
B. Murray 4346. Not recorded in this study.

Rhizocarpon disporum (Naeg. *ex* Hepp) Muell. Arg.
B. Murray 4351. Not recorded in this study.

Rinodina roscida (Somm.) Arn.
B. Murray 4341. Not recorded in this study.

Rinodina turfacea (Wahlenb.) Koerb.
B. Murray 6238, det. J.W. Thomson. Not recorded in this study.

Solorina saccata (L.) Ach.
B. Murray 4362. Frequent; moist to dry tundra.

Solorina spongiosa (Sm.) Anzi
B. Murray 4356. Not recorded in this study.

Sphaerophorus globosus (Huds.) Vain.
D.A. Walker, 22 August 1974, det. B. Murray. Frequent; dry to moist acidic tundra at coast in Kuparuk field.

Stereocaulon alpinum Laur.
B. Murray 4375, det. I.M. Lamb. Frequent; moist to dry tundra, snow patches.

Stereocaulon rivulorum Magn.
B. Murray 4365, det. I.M. Lamb. Too scanty and depauperate to determine with certainty. Not recorded in this study.

Thamnolia subuliformis (Ehrh.) W. Culb.
B. Murray 4336. Common; moist to dry tundra. Most (about 98%) of the *Thamnolia* in the region is *T. subuliformis*.

Thamnolia vermicularis (Sw.) Ach. *ex* Schaer.
D.A. Walker 1975, det. S. Shushan. Apparently infrequent; only a few thalli appeared in collections of *Thamnolia* from the entire region.

Toninia cumulata (Sommerf.) Th. Fr.
D.A. Walker 13, det. J.W. Thomson. Collected from bare soil in dunes area (Figure A1, point 9).

Toninia lobulata (Somm.) Lynge
B. Murray 6216, det. J.W. Thomson. Not recorded in this study.

Verrucaria devergens Nyl.
B. Murray 4354, det. J.W. Thomson. Not recorded in this study.

Xanthoria candelaria (L.) Th. Fr.
D.A. Walker 75-332, det. J.W. Thomson. Collected on wood from strand line at coast (Figure A1, point 6).

Xanthoria elegans (Link) Th. Fr.
B. Murray 4353. On pebbles on gravelly pingos and rocks.

APPENDIX B. ENVIRONMENTAL AND SPECIES DATA FOR THE PERMANENT STUDY PLOTS

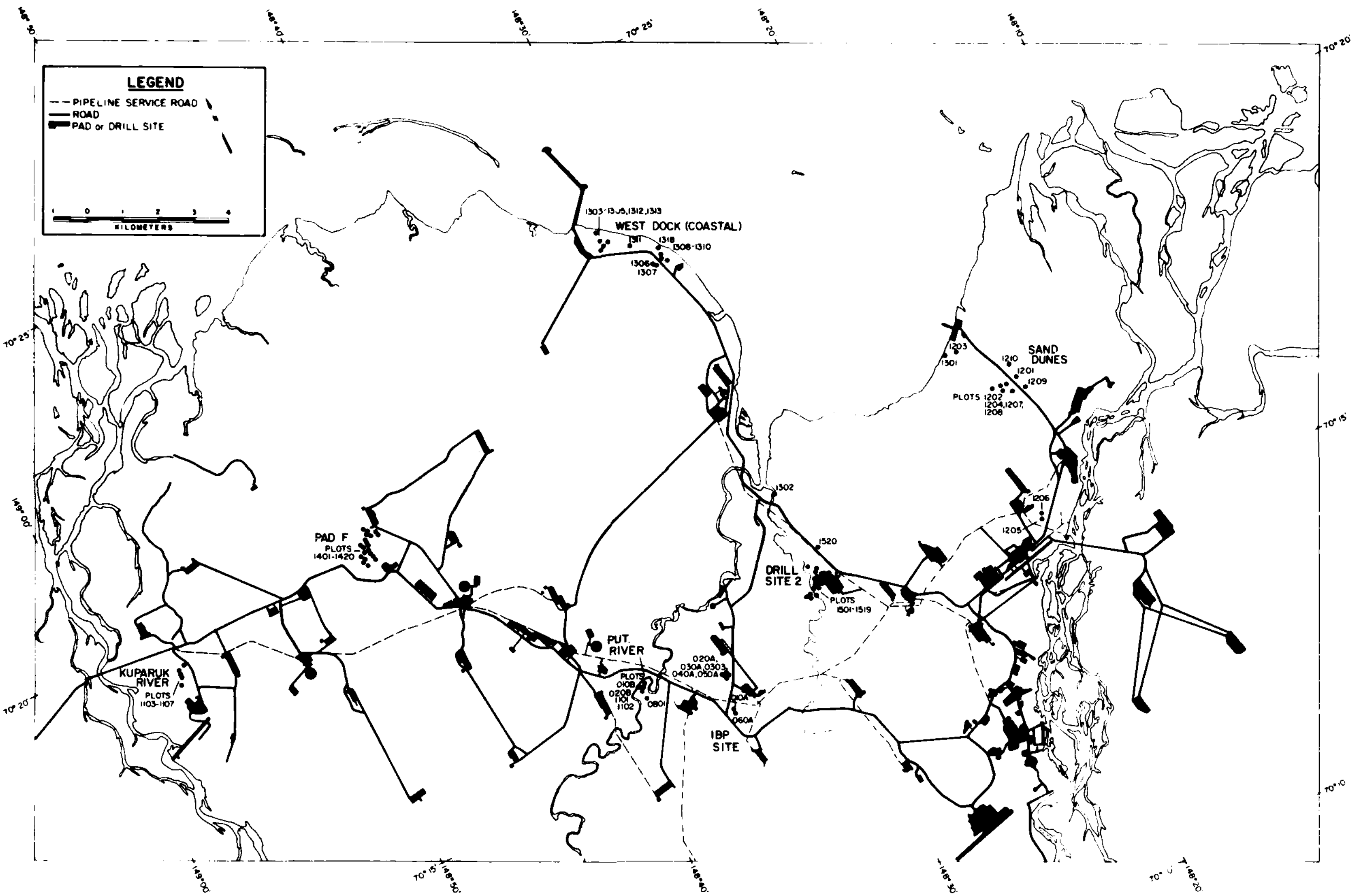


Figure B1. Locations of permanent study plots.

Table B1. Soils data, physical variables.
The variables and their units are described in Table 6.

PLOTNUM	SMOIS77	BDENS77	SAND	SILT	CLAY	FLDCAP	WILTPT	AVH2O	HYGMOIS	H2OABSN	ORGMAT
010A	19	1.09	24.9	56.1	19.0	49.0	31.5	17.5	3.0	115.3	19.1
010B	46	.78	84.1	9.3	6.6	14.7	14.7	.1	1.0	58.1	6.5
020A	124	.49	5.8	73.5	20.7	86.8	60.7	26.1	6.0	215.0	33.1
020B	81	.71	18.7	60.2	21.1	56.9	35.5	21.4	3.1	121.8	20.0
0203	42	1.04	.	.	.	88.9	66.3	22.6	7.5	190.0	37.3
030A	15	.42	22.9	60.7	16.4	70.5	48.4	22.1	4.3	164.0	23.1
030B	104	.55	5.8	69.8	24.4	92.0	77.2	14.8	5.0	258.7	38.9
0303	172	.36	.	.	.	88.0	76.0	12.0	6.1	210.3	40.2
040A	274	.24	8.3	72.7	19.0	83.3	64.3	19.0	5.1	247.4	31.9
040B	198	.33	6.4	70.9	22.7	88.9	84.2	4.7	6.3	289.2	41.1
050A	402	16	6.2	75.8	18.0	76.9	74.4	2.5	3.7	269.1	32.3
050B	417	.15	6.2	70.8	23.0	103.3	95.8	7.5	5.6	323.9	42.7
060A	.	.	35.7	45.3	19.0	50.9	29.0	21.9	2.2	134.4	17.6
060B	522	.12	12.1	47.4	40.5	173.1	157.5	15.6	8.5	628.4	63.6
0801	15	1.47	26.5	50.9	22.6	32.5	12.7	18.8	1.7	65.6	8.7
0901	43	78	23.2	61.0	15.8	44.0	35.7	8.3	2.8	113.3	18.5
0902	55	69	17.2	66.6	16.2	42.7	28.3	14.4	2.4	113.6	14.6
1001	31	73	51.9	31.0	17.1	45.2	33.3	11.9	2.9	99.2	19.8
1002	21	.62	51.8	30.9	17.3	60.8	55.1	5.7	4.9	160.9	37.6
1101	71	.75	52.2	32.6	15.2	23.8	18.8	5.0	1.4	91.4	9.2
1102	62	.67	9.1	65.4	25.5	48.7	32.9	15.8	3.2	122.7	19.1
1103	52	86	33.4	51.8	14.8	23.1	14.6	8.5	1.5	70.9	8.0
1104	21	93	31.9	51.7	16.4	40.7	28.1	12.6	2.6	108.2	14.5
1105	6	1.54	72.2	21.7	6.1	7.5	2.8	4.7	.5	27.0	2.1
1106	8	1.28	71.9	20.5	7.6	10.9	6.8	4.1	.7	43.0	3.9
1107	49	91	44.4	41.6	14.0	20.9	12.2	8.7	1.5	66.0	7.1
1201	3	1.27	76.2	16.9	6.9	4.4	2.1	2.3	.3	29.7	1.1
1202	12	1.23	49.5	40.5	10.0	9.1	5.1	4.0	.6	44.2	2.8
1203	51	89	32.8	53.7	13.5	53.2	37.6	15.6	1.9	172.4	18.1
1204	30	.98	40.6	48.8	10.6	12.4	7.6	4.8	.7	52.2	4.4
1205	91	.56	.	.	.	21.0	17.1	3.9	1.5	110.2	9.9
1206	247	24	.	.	.	20.1	16.5	3.6	1.2	92.5	9.5
1207	7	1.15	31.8	58.7	9.5	.	.	.	.9	.	5.5
1208	3	1.28	.	.	.	.	.	.	.	.	.
1209	33	89	79.7	14.0	6.3	.	.	.	.3	.	3.0
1210	25	93	40.8	49.7	9.5	.	.	.	.8	.	5.1
1301	29	97	21.8	62.6	15.6	24.2	14.5	9.7	1.2	73.2	7.4
1302	48	.99	43.2	43.7	13.1	17.9	12.6	5.3	.8	69.7	6.7
1303	158	.34	5.9	30.8	63.3	77.0	33.0	44.0	5.7	114.3	39.9
1304	166	.31	48.7	18.2	33.1	106.8	92.8	14.0	8.4	280.0	70.3
1305	50	.72	36.8	26.6	36.6	63.6	42.4	21.2	5.2	108.0	29.9
1306	202	.35	26.3	25.5	48.2	93.6	57.5	36.1	7.8	204.0	43.1
1307	86	.61	12.6	29.0	58.4	59.9	41.8	18.1	4.7	119.6	26.7
1308	577	.12	91.0	4.2	4.8	137.5	118.5	19.0	10.4	404.2	65.8
1309	176	.35	67.4	22.9	9.7	.	.	.	4.4	.	43.8
1310	290	.24	94.2	3.6	2.2	111.9	88.3	23.6	6.6	309.5	62.3
1311	23	1.21	96.9	2.0	1.1	95.1	77.6	17.5	7.0	167.2	66.8
1312	119	.42	87.6	6.4	6.0	.	.	.	5.0	.	47.3
1313	171	.31	92.7	4.1	3.2	119.5	96.3	23.2	7.4	231.6	70.4
1318	152	.41	75.7	13.5	10.8	.	.	.	3.3	.	39.4
1401	19	.77	50.5	29.9	19.6	22.1	10.7	11.4	2.0	62.6	7.7
1402	452	.15	.	.	.	99.8	73.0	26.8	7.3	285.4	50.1
1403	81	.62	4.0	46.7	49.3	81.0	62.4	18.6	7.3	162.4	41.9
1404	295	.22	14.0	63.9	22.1	103.4	78.8	24.6	8.5	310.1	59.2
1405	252	.24	.	.	.	98.5	71.8	26.7	7.7	219.0	55.7
1406	153	.38	5.2	51.8	43.0	73.5	48.4	25.1	6.1	163.7	39.8
1407	271	.22	.	.	.	109.2	93.1	16.1	7.9	295.4	61.6
1408	611	.11	.	.	.	126.3	81.2	45.1	10.1	360.5	63.2
1409	119	.44	.	.	.	95.9	60.1	35.8	7.8	169.8	42.0
1410	178	.33	.	.	.	84.9	63.0	21.9	7.4	211.4	51.3
1411	5	1.37	.	.	.	23.1	18.0	5.1	2.6	70.5	11.7
1412	80	.48	.	.	.	96.8	65.2	31.6	8.9	175.7	44.5
1413	469	.14	.	.	.	124.5	111.1	13.4	8.3	247.3	60.7
1414	344	.22	.	.	.	99.8	79.5	20.3	5.8	201.3	42.7
1415	191	27	39.4	43.7	16.9	125.1	72.6	52.4	10.4	210.5	51.7
1416	106	44	.	.	.	74.1	52.7	21.4	8.0	151.7	38.1
1417	75	59	.	.	.	54.6	28.8	25.8	4.8	108.5	22.3
1418	129	39	.	.	.	88.5	65.9	22.6	8.8	183.0	46.4
1419	83	.61	.	.	.	72.1	35.6	36.5	5.2	106.1	26.3
1420	336	23	38.0	48.8	13.2	125.8	104.9	20.9	9.1	346.5	64.3
1421											
1422				.	.	.	.	.	.	.	
1501	171	38	22.9	62.8	14.3	56.4	44.1	12.3	4.3	189.7	27.3
1502	79	.44	.	.	.	57.5	36.8	20.7	4.6	141.2	22.6
1503	207	31	.	.	.	77.5	62.0	15.5	6.5	202.8	38.6
1504	63	78	17.4	64.9	17.7	38.0	23.6	14.4	2.9	94.1	13.9
1505	48	60	.	.	.	29.6	19.8	9.8	2.8	76.2	12.3
1506	15	1.49	.	.	.	18.1	7.9	10.2	1.2	45.8	5.2
1507	27	1.01	.	.	.	19.3	11.7	7.6	1.4	60.2	6.2
1508	38	1.01	.	.	.	5.9	3.6	2.3	.4	36.8	2.3
1509	37	82	.	.	.	24.9	15.3	9.6	1.9	82.3	9.1
1510	34	97	21.0	61.9	17.1	50.4	33.3	17.1	4.1	108.3	20.0
1511	122	51	17.6	64.8	17.6	46.8	30.7	16.1	3.3	105.3	17.7
1512	89	55	.	.	.	40.0	34.8	5.2	3.8	121.8	24.3
1513	34	75	.	.	.	22.8	12.6	10.2	1.4	56.9	6.9
1514	53	90	.	.	.	29.6	16.0	13.6	1.8	82.6	9.3
1515	70	76	.	.	.	44.8	20.5	24.3	2.7	96.7	13.1
1516	136	44	30.5	55.0	14.5	30.9	24.9	6.0	2.5	105.7	14.9
1517	109	51	.	.	.	44.7	32.8	11.9	3.0	159.2	20.0
1518	178	35	.	.	.	70.8	37.7	33.1	3.6	174.2	25.3
1519	116	47	16.7	67.2	16.1	50.8	44.0	6.8	4.2	144.1	21.3
1520	19	90	.	.	.	18.3	12.5	5.8	1.8	60.7	9.0
1521	.					.	.		.		

Table B2. Soils data, chemical variables.
The variables and their units are described in Table 6.

PLOTNUM	PH	NH4	NO3	CO3	P	K	CA	MG
010A	7.47	12.4	12.1	20.0	31.0	535.0	6298.0	185.0
010B	7.59	9.8	8.9	15.1	15.0	782.0	3571.0	170.0
020A	7.20	.	.	13.2	.	.	.	.
020B	7.37	9.8	8.0	19.3	8.0	578.0	6215.0	174.0
0203	7.32	17.0	6.9	4.0	17.0	288.0	9472.0	348.0
030A	7.40	14.3	9.2	22.7	5.0	38.0	4516.0	119.0
030B	6.89	13.1	10.7	3.5	2.0	600.0	7178.0	344.0
0303	7.38	10.7	12.1	4.2	14.0	236.0	6793.0	329.0
040A	7.43	15.8	13.5	21.7	13.0	488.0	8470.0	105.0
040B	7.03	11.8	18.6	3.3	16.0	485.0	7700.0	355.0
050A	7.40	.	.	20.8	.	.	.	.
050B	7.12	24.2	20.4	6.0	14.0	491.0	5476.0	385.0
060A	7.60	29.2	9.8	27.5	4.0	40.0	2656.0	111.0
060B	6.30	.	.	.8	.	.	.	.
0801	7.80	7.8	7.5	39.3	3.0	34.0	2332.0	145.0
0901	7.42	13.2	10.3	19.2	16.0	412.0	6105.0	252.0
0902	7.61	10.7	7.6	19.9	16.0	369.0	5400.0	142.0
1001	7.50	13.7	13.4	3.3	14.0	387.0	7260.0	311.0
1002	7.20	20.3	9.4	2.5	16.0	129.0	4982.0	416.0
1101	7.61	15.0	7.5	14.7	14.0	362.0	3774.0	65.0
1102	7.59	22.2	10.2	14.7	23.0	341.0	6105.0	179.0
1103	7.60	15.9	5.1	3.1	.1	36.0	1843.0	86.0
1104	7.50	9.1	12.7	2.9	1.0	32.0	3439.0	181.0
1105	7.80	7.1	5.2	1.1	.1	26.0	623.0	45.0
1106	7.60	14.7	4.9	1.9	.1	31.0	1459.0	126.0
1107	7.70	17.5	4.5	4.6	.1	36.0	1377.0	123.0
1201	8.30	9.1	4.4	30.9	.1	11.0	1450.0	52.0
1202	8.40	12.8	4.3	33.4	.1	26.0	1342.0	69.0
1203	7.60	19.6	7.2	24.0	10.0	51.0	1910.0	118.0
1204	7.90	16.1	5.3	33.0	1.0	70.0	1327.0	196.0
1205	7.40	23.1	5.8	22.0	7.0	47.0	1682.0	62.0
1206	7.50	40.1	5.1	14.3	2.0	34.0	1498.0	50.0
1207	8.00	.	.	27.2	.	.	.	.
1208	.	.	.	.	.	.	.	.
1209	8.10	.	.	26.4	.	.	.	.
1210	7.90	.	.	26.7	.	.	.	.
1301	7.90	13.3	9.3	29.9	.1	36.0	1627.0	274.0
1302	7.50	18.3	5.0	24.7	.1	92.0	1399.0	286.0
1303	5.18	19.4	9.2	.1	2.0	389.0	2558.0	638.0
1304	5.29	37.0	10.2	.6	4.0	411.0	3456.0	883.0
1305	5.50	12.7	14.3	.1	3.0	349.0	3648.0	627.0
1306	5.85	15.0	9.7	.6	1.0	356.0	6816.0	845.0
1307	7.37	21.9	7.4	3.0	11.0	461.0	6545.0	451.0
1308	6.30	17.4	16.8	.8	1.0	578.0	6336.0	1132.0
1309	7.60	.	.	3.8	.	.	.	.
1310	5.20	.	.	0	.	.	.	.
1311	5.10	.	.	0	.	.	.	.
1312	5.90	.	.	0	.	.	.	.
1313	5.00	.	.	0	.	.	.	.
1318	6.60	.	.	0	.	.	.	.
1401	7.30	7.6	7.3	.7	8.0	188.0	2979.0	257.0
1402	5.71	11.8	10.5	.8	1.0	156.0	5995.0	224.0
1403	5.91	17.6	9.6	.1	1.0	216.0	6105.0	355.0
1404	5.43	16.1	12.7	.6	3.0	221.0	4366.0	255.0
1405	5.61	17.4	11.4	.1	4.0	224.0	6215.0	433.0
1406	5.46	28.5	7.9	.6	3.0	219.0	3941.0	268.0
1407	5.45	13.1	13.3	.1	2.0	195.0	5199.0	311.0
1408	6.35	.	.	1.1	1.0	280.0	8000.0	819.0
1409	6.26	12.4	19.6	1.0	3.0	250.0	8768.0	646.0
1410	5.60	17.6	19.3	.7	4.0	246.0	5310.0	272.0
1411	7.49	13.7	19.1	2.2	16.0	218.0	5587.0	197.0
1412	6.62	14.0	40.0	1.2	3.0	209.0	10176.0	870.0
1413	5.71	31.9	16.3	.8	4.0	220.0	4736.0	326.0
1414	6.45	10.7	13.5	1.3	2.0	172.0	5550.0	265.0
1415	6.65	19.5	24.0	1.0	.2	186.0	9760.0	507.0
1416	6.88	12.7	19.1	.9	3.0	297.0	8525.0	496.0
1417	7.53	8.2	16.6	10.0	13.0	197.0	7590.0	223.0
1418	6.57	13.9	17.6	1.3	5.0	290.0	9417.0	861.0
1419	6.73	10.3	43.0	1.0	1.0	162.0	7040.0	691.0
1420	5.75	13.5	10.1	.1	2.0	261.0	5643.0	355.0
1421	.	.	.	.	.	.	.	.
1422	.	.	.	.	.	.	.	.
1501	7.37	13.5	10.5	17.4	11.0	258.0	6325.0	126.0
1502	7.59	13.8	19.2	20.2	24.0	281.0	7865.0	274.0
1503	7.45	17.5	12.0	5.1	12.0	212.0	6490.0	377.0
1504	7.64	11.8	10.8	21.3	11.0	227.0	5830.0	101.0
1505	7.84	15.9	10.3	8.9	13.0	224.0	5458.0	307.0
1506	7.75	8.0	9.9	18.1	10.0	179.0	4255.0	277.0
1507	7.73	8.3	14.8	17.6	9.0	402.0	3811.0	138.0
1508	7.83	6.6	10.6	13.9	9.0	330.0	2683.0	44.0
1509	7.57	7.8	10.0	24.5	10.0	241.0	4440.0	119.0
1510	7.38	7.6	9.9	4.3	10.0	375.0	5968.0	200.0
1511	7.60	6.6	10.3	20.7	10.0	349.0	6353.0	60.0
1512	7.54	8.2	12.4	19.5	11.0	378.0	5495.0	101.0
1513	7.73	7.0	11.3	16.1	12.0	234.0	4403.0	222.0
1514	7.65	7.3	10.4	23.7	9.0	225.0	5143.0	72.0
1515	7.62	8.3	9.1	22.9	10.0	197.0	6133.0	91.0
1516	7.59	7.2	11.2	23.6	10.0	386.0	4699.0	95.0
1517	7.56	7.3	12.6	22.9	9.0	151.0	5476.0	65.0
1518	7.55	12.8	7.5	29.1	13.0	261.0	6380.0	123.0
1519	7.45	8.6	12.0	7.7	11.0	471.0	5920.0	247.0
1520	7.80	8.7	12.5	20.0	13.0	298.0	5032.0	196.0
1521	.	.	.	.	.	.	.	.

Table B3. Site factors.
The variables and their units are described in Table 6.

PLOTNUM	LOCATN	TEMPREG	MOISREG	SNOWREG	CRYOREG	VEGTYPE	TOPOFEA	SLOPE	HUMMOCK	ASPECT
010A	1	3	1	2	3	B2	1	0	2	
010B	2	3	1	1	3	B1	2	0	2	
020A	1	3	3	3	1	U3	5	0	2	
020B	2	3	2	3	2	U3	3	0	2	
0203	3	3	2	3	2	U2	3	1	3	E
030A	1	3	3	3	1	U4	5	0	2	
030B	3	3	3	3	2	U4	4	0	2	
0303	1	3	3	3	2	U4	5	0	2	
040A	1	3	4	3	1	M2	7	0	1	
040B	3	3	4	3	1	M2	4	0	1	
050A	1	3	4	3	1	M4	4	0	1	
050B	3	3	4	3	1	M4	4	0	1	
060A	1	3	5	3	1	E2	8	0	1	
060B	3	3	5	3	1	E2	8	0	1	
0801	2	3	3	3	4	B3	13	0	2	
0901	3	3	1	5	3	U6	2	3	4	W
0902	3	3	1	5	1	U7	9	1	3	W
1001	3	3	1	4	4	U10	2	2	3	N
1002	3	3	2	2	1	U10	14	0	1	
1101	2	3	3	5	1	M5	10	0	1	
1102	2	3	2	4	2	U9	11	2	2	W
1103	4	3	3	3	1	U8	16	0	1	
1104	4	3	2	4	1	B7	17	3	3	W
1105	4	3	1	1	1	B4	16	1	1	E
1106	4	3	1	2	1	B13	16	0	1	
1107	4	3	2	3	1	M7	16	0	1	
1201	5	2	1	2	1	B9	18	2	1	S
1202	5	2	1	2	1	B13	18	1	1	E
1203	5	2	4	3	1	M3	7	0	1	
1204	5	2	2	2	1	U14	5	0	2	
1205	5	2	4	3	1	M3	4	0	2	
1206	5	2	5	3	1	E3	8	0	1	
1207	5	2	1	1	2	B5	3	0	2	
1208	5	2	1	1	2	B13	3	2	1	E
1209	5	2	3	3	1	M11	6	0	1	
1210	5	2	2	2	1	U14	5	0	2	
1301	6	1	1	1	2	B10	20	1	2	E
1302	6	1	5	5	1	M9	21	0	1	
1303	6	1	3	3	2	U12	5	0	2	
1304	6	1	4	3	1	M2	4	0	1	
1305	6	1	2	2	3	B12	1	0	3	
1306	6	1	4	3	1	M8	22	0	1	
1307	6	1	5	3	1	E2	8	0	1	
1308	6	1	3	3	1	M2	7	0	1	
1309	6	1	3	3	3	U13	25	0	2	
1310	6	1	4	3	1	M10	4	0	2	
1311	6	1	3	3	2	U12	3	0	2	
1312	6	1	2	1	1	B8	20	0	2	
1313	6	1	3	3	3	B15	5	0	2	
1318	6	1	4	3	1	M9	21	0	1	
1401	7	2	1	2	3	B2	1	0	2	
1402	7	2	5	3	1	E1	8	0	1	
1403	7	2	3	3	1	U3	3	0	2	
1404	7	2	4	3	1	M1	12	0	1	
1405	7	2	2	3	3	U1	23	0	3	
1406	7	2	3	3	2	U1	5	0	2	
1407	7	2	4	3	1	M1	12	0	2	
1408	7	2	5	3	1	E1	8	0	1	
1409	7	2	3	3	1	U4	1	0	2	
1410	7	2	2	2	3	U1	5	0	3	
1411	7	2	1	1	2	B1	2	3	1	N
1412	7	2	1	2	3	B2	1	0	2	
1413	7	2	5	3	1	M4	6	0	1	
1414	7	2	4	3	1	M1	12	0	1	
1415	7	2	2	3	3	U1	5	0	3	
1416	7	2	2	5	2	U6	2	3	4	W
1417	7	2	2	5	1	U7	9	1	1	W
1418	7	2	3	2	1	U10	15	2	4	
1419	7	2	3	3	4	B3	13	0	2	
1420	7	2	4	3	1	M1	7	0	1	
1421	7	2	2	4	2	B14	2	3	3	W
1422	7	2	2	2	1	U10	14	0	2	
1501	8	2	4	3	1	M2	7	0	2	
1502	8	2	2	2	1	U10	15	2	4	
1503	8	2	4	3	1	M2	6	0	2	
1504	8	2	2	3	2	U3	3	0	2	
1505	8	2	1	2	3	B1	1	0	2	
1506	8	2	2	3	4	B3	13	0	2	
1507	8	2	1	5	3	B6	11	2	3	W
1508	8	2	2	5	1	M5	10	0	1	
1509	8	2	2	5	2	U6	11	3	4	S
1510	8	2	2	3	2	U3	5	0	2	
1511	8	2	4	3	1	M2	4	0	1	
1512	8	2	3	3	2	U3	4	0	2	
1513	8	2	1	1	3	B1	1	0	2	
1514	8	2	3	3	1	U4	7	0	2	
1515	8	2	2	3	1	U3	5	0	2	
1516	8	2	4	3	1	M2	4	0	2	
1517	8	2	5	3	1	M4	12	0	1	
1518	8	2	5	3	1	E1	8	0	1	
1519	8	2	3	3	2	U3	3	0	2	
1520	8	2	1	1	3	B1	2	3	2	N
1521	8	2	1	5	1	B4	24	0	1	

Table B3 (cont'd). Site factors.

The variables and their units are described in Table 6.

PLOTNUM	SOILCOV	ROCKCOV	H2OCOV	THAW77	H2ODPTH	MARL	CLICCOV	FLICCOV	BRYOCOV	ERECDED	PROSDED	PLTSIZE
010A	9	1	0	44	0	0	16	3	12	1	30	1
010B	5	0	0	59	0	0	14	6	7	3	24	1
020A	2	0	0	31	0	0	2	5	90	35	45	2
020B	0	0	0	37	0	0	0	12	85	17	28	1
0203	0	0	0	24	0	0	0	10	87	9	27	1
030A	0	0	0	38	0	0	0	1	80	25	20	2
030B	1	0	0	29	0	0	0	0	57	30	36	1
0303	1	0	0	42	0	0	1	1	87	19	21	1
040A	0	0	0	31	0	30	0	0	82	12	25	1
040B	19	0	0	36	0	45	0	0	42	21	10	1
050A	11	0	28	30	0	30	0	0	13	31	17	1
050B	33	0	61	34	6	83	0	0	32	9	4	1
060A	25	0	100	42	23	90	0	0	0	17	70	2
060B	53	0	100	26	62	0	0	0	1	24	17	1
0801	7	0	0	61	0	0	18	7	1	7	2	2
0901	5	1	0	100	0	0	4	2	27	12	20	1
0902	1	0	0	37	0	0	0	0	70	4	22	1
1001	17	5	0	37	0	0	10	7	10	5	19	1
1002	0	1	0	73	0	0	0	1	15	50	5	2
1101	9	0	0	41	0	0	0	0	24	16	47	1
1102	0	0	0	33	0	0	0	0	94	6	11	1
1103	1	0	0	50	0	0	0	0	25	30	60	2
1104	80	1	0	100	0	0	0	0	1	3	1	2
1105	98	80	0	100	0	0	0	0	0	0	2	2
1106	30	0	0	95	0	0	0	0	2	25	5	2
1107	2	0	0	63	0	0	0	0	1	20	5	2
1201	90	0	0	92	0	0	0	0	0	4	0	1
1202	70	0	0	68	0	0	1	0	1	1	1	3
1203	0	0	0	19	0	5	0	0	100	40	25	2
1204	60	0	0	66	0	0	0	0	0	10	5	2
1205	0	0	0	31	0	5	0	0	95	15	5	1
1206	0	0	90	34	31	60	0	0	100	0	0	1
1207	40	0	0	64	0	0	1	0	1	0	30	1
1208	70	0	0	60	0	0	1	0	0	0	1	1
1209	60	0	0	48	0	0	0	0	0	25	15	1
1210	55	0	0	57	0	0	0	0	1	20	15	1
1301	25	0	0	44	0	0	5	3	1	45	30	2
1302	5	0	5	51	0	0	0	0	0	10	10	2
1303	0	0	0	19	0	0	1	1	40	50	30	2
1304	25	0	5	25	0	0	0	0	1	40	30	2
1305	15	0	0	23	0	0	40	3	3	3	5	1
1306	1	0	0	22	0	0	0	0	20	40	50	2
1307	60	0	7	31	10	5	0	0	0	5	40	2
1308	0	0	0	19	0	0	0	0	100	45	50	2
1309	50	0	0	56	0	0	0	0	0	60	60	1
1310	10	0	1	21	0	0	1	0	5	10	40	1
1311	2	0	0	11	0	0	1	1	10	40	30	1
1312	85	0	0	43	0	0	0	0	0	3	2	1
1313	25	0	0	25	0	0	25	2	2	15	5	1
1318	10	0	0	35	0	0	0	0	1	50	5	1
1401	2	1	0	33	0	0	10	10	15	1	28	1
1402	0	0	33	33	5	0	0	0	0	15	92	1
1403	0	0	0	19	0	0	1	4	83	22	24	1
1404	0	0	0	27	0	0	0	0	33	19	22	1
1405	10	0	0	23	0	0	5	5	30	15	10	2
1406	0	0	0	23	0	0	1	8	64	24	24	1
1407	60	0	0	27	0	0	0	0	30	15	20	2
1408	0	0	54	31	1	0	0	0	0	5	19	1
1409	0	0	0	17	0	0	1	2	70	25	50	2
1410	0	0	0	23	0	0	20	8	20	10	30	2
1411	12	20	0	82	0	0	6	2	1	1	14	1
1412	20	0	0	28	0	0	8	3	5	3	55	2
1413	69	0	14	30	0	64	0	0	0	14	6	1
1414	50	0	0	29	0	0	0	0	40	20	15	2
1415	10	0	0	26	0	0	3	27	22	10	13	1
1416	1	0	0	34	0	0	7	18	15	15	20	2
1417	0	0	0	27	0	0	0	2	85	1	20	2
1418	1	0	0	37	0	0	0	1	1	10	10	2
1419	40	0	0	28	0	0	3	7	5	1	35	2
1420	34	0	0	27	0	0	0	0	18	15	6	1
1421	1	0	0			0	2	1	25	25	10	2
1422	6	5	0			0	2	1	5	20	20	3
1501	0	0	6	35	3	44	0	0	93	11	6	1
1502	1	0	0	38	0	0	1	1	65	20	15	2
1503	5	0	1	31	0	50	0	0	87	10	12	1
1504	0	0	0	34	0	0	1	8	82	12	52	1
1505	8	0	0	46	0	0	18	9	6	2	38	1
1506	20	0	0	47	0	0	10	10	30	10	30	2
1507	8	0	0	68	0	0	1	0	38	2	27	1
1508	14	0	0	56	0	0	0	0	27	13	5	1
1509	5	0	0	48	0	0	0	1	10	20	40	2
1510	1	0	0	23	0	0	0	5	63	15	39	1
1511	13	0	0	40	0	31	0	0	12	23	14	1
1512	0	0	0	29	0	0	0	0	54	15	30	1
1513	15	0	0	38	0	0	10	3	5	1	30	2
1514	0	0	0	29	0	0	0	1	35	40	20	2
1515	0	0	0	31	0	0	1	13	60	25	60	2
1516	0	0	0	32	0	36	0	0	91	10	9	1
1517	5	0	5	36	3	5	0	0	60	30	10	2
1518	40	0	100	33	14	40	0	0	0	5	20	2
1519	1	0	0	31	0	0	0	2	71	16	56	1
1520	15	20	0	54	0	0	25	3	5	1	15	2
1521	95	95	0			0	0	0	0	0	1	3

Table B3 (cont'd).

PLOTNUM	CARFECE	CARGRAZ	BRWNLEM	COLLLEM	MISBIRD	FOX	PTARMIG	GOOSE	SQRRL	BEAR
010A	.2	0	0	.1	.2	.1	.8	0	0	0
010B	5	0	0	0	0	.1	0	0	.2	0
020A	.1	0	0	0	0	0	0	0	0	0
020B	1	0	0	0	0	0	0	0	0	0
0203	.4	0	0	.2	.1	0	0	0	0	0
030A	.	.	.	.	.	.	.	.	.	.
030B	.1	.2	.4	0	.1	0	0	0	0	0
0303	.1	.2	0	0	0	0	0	0	0	0
040A	0	.3	0	0	0	0	0	0	0	0
040B	0	.4	0	0	0	0	0	0	0	0
050A	0	0	0	0	0	0	0	0	0	0
050B	0	0	0	0	0	0	0	0	0	0
060A	0	0	0	0	0	0	0	0	0	0
060B	0	0	0	0	0	0	0	0	0	0
0801	.	.	.	.	.	.	.	.	.	.
0901	4	0	0	.7	.3	.2	0	0	0	0
0902	2	0	0	.3	0	0	0	0	0	0
1001	6	0	0	0	0	0	0	0	0	0
1002	0	0	0	0	.1	0	0	0	.1	0
1101	0	.6	0	0	0	0	0	0	0	0
1102	.1	.2	0	0	.1	0	0	0	0	0
1103	0	0	0	0	0	0	.1	0	0	0
1104	.	.	.	.	.	.	.	.	.	.
1105	.	.	.	.	.	.	.	.	.	.
1106	.	.	.	.	.	.	.	.	.	.
1107	.	.	.	.	.	.	.	.	.	.
1201	0	0	0	0	0	0	0	0	.2	0
1202	0	0	0	0	0	0	0	0	.1	0
1203	0	0	0	0	0	0	0	0	0	0
1204	0	0	0	0	0	0	0	0	0	0
1205	0	0	0	0	0	0	0	.8	0	0
1206	0	0	0	0	0	0	0	0	0	0
1207	2	0	0	0	.1	0	0	0	.1	0
1208	0	0	0	0	0	0	0	0	.2	0
1209	0	0	0	0	0	0	0	.4	.2	0
1210	.1	0	0	0	0	.1	0	.2	0	0
1301	.	.	.	.	.	.	.	.	.	.
1302	0	0	0	0	0	0	0	.1	0	0
1303	.	.	.	.	.	.	.	.	.	.
1304	0	0	0	0	0	0	0	0	0	0
1305	2	0	0	0	.1	0	0	0	0	0
1306	0	0	.1	0	0	0	0	0	0	0
1307	0	0	0	0	0	0	0	0	0	0
1308	0	0	0	0	0	0	.1	0	0	0
1309	0	0	0	0	0	0	0	.1	0	0
1310	0	0	0	0	0	0	0	0	0	0
1311	1	0	0	0	0	0	0	0	0	0
1312	1	0	0	0	0	0	0	.4	0	0
1313	6	0	0	0	0	0	0	0	0	0
1314	1	0	0	0	0	0	.1	.9	0	0
1401	7	0	0	0	0	0	.5	0	0	0
1402	0	0	0	0	.3	0	1	0	0	0
1403	1	0	0	0	0	0	0	0	0	0
1404	0	0	0	0	.2	0	0	0	0	0
1405	1	0	0	0	.1	0	0	0	0	0
1406	3	1	0	0	1	0	0	0	0	0
1407	0	0	0	0	0	0	0	0	0	0
1408	0	0	0	0	.6	0	0	0	0	0
1409	.	.	.	.	.	.	.	.	.	.
1410	.	.	.	.	.	.	.	.	.	.
1411	4	0	0	0	.3	0	.1	0	0	0
1412	.	.	.	.	.	.	.	.	.	.
1413	0	0	0	0	0	0	0	.1	0	0
1414	.	.	.	.	.	.	.	.	.	.
1415	4	0	0	0	.3	0	.1	0	0	0
1416	1	0	0	.1	0	0	0	0	0	0
1417	0	0	0	.1	0	.1	0	0	0	0
1418	0	0	0	0	.1	0	0	0	1	1
1419	0	0	0	0	0	0	0	0	0	0
1420	1	0	0	0	.4	0	0	0	0	0
1421	0	0	0	1	0	0	0	0	0	0
1422	.1	0	0	0	.1	.1	.1	0	1	0
1501	0	.2	0	0	.1	0	0	0	0	0
1502	0	0	0	0	.1	0	.1	0	0	0
1503	0	.2	0	2	0	0	0	0	0	0
1504	.4	0	0	0	0	0	0	0	0	0
1505	.3	0	0	0	0	0	.1	0	0	0
1506	0	0	0	0	0	0	0	0	0	0
1507	.3	0	0	4	.3	0	0	0	0	0
1508	0	0	0	0	.1	0	0	0	0	0
1509	0	0	0	1	0	0	0	0	0	0
1510	0	.1	0	0	0	0	0	0	0	0
1511	0	.2	0	0	0	0	0	0	0	0
1512	0	0	0	0	4	0	0	2	0	0
1513	1	0	0	0	0	0	0	0	0	0
1514	0	0	0	0	0	0	0	0	0	0
1515	0	0	0	0	0	0	0	0	0	0
1516	0	0	.1	0	0	0	0	0	0	0
1517	0	0	0	0	0	0	0	0	0	0
1518	0	0	0	0	0	0	0	0	0	0
1519	0	0	0	0	0	.1	0	0	0	0
1520	0	0	0	0	0	0	0	0	0	0
1521	0	0	0	0	0	0	0	0	0	0

Table B4. Raw species data for 1- × 10-m plots.

The units are percentage of cover, with frequency in parentheses.

	010A	010B	020B	0203	030B	0303	040A	040B
VASCULAR PLANTS								
2 ALOPECURUS ALPINUS ALPINUS	1(.1)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
3 ANDROSACE CHAMAEJASME LEHMANNIANA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
4 ANDROSACE SEPTENTRIONALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
5 ANEMONE PARVIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
6 ANEMONE RICHARDSONII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
9 ARCTAGROSTIS LATIFOLIA S L.	0(0)	.1(.1)	.1(.6)	.1(.3)	0(0)	0(0)	0(0)	0(0)
10 ARCTOPHILA FULVA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
12 ARMERIA MARITIMA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
13 ARTEMISIA ARCTICA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
14 ARTEMISIA BOREALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
15 ARTEMISIA GLOMERATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
18 ASTRAGALUS ALPINUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
19 ASTRAGULUS UMBELLATUS	0(0)	1.6(1.0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
22 BRAYA PURPURASCENS	0(0)	.1(.3)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
23 BRAYA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
24 BROMUS PUMPELLIANUS ARCTICUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
25 CALTHA PALUSTRIS ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
27 CARDAMINE DIGITATA	.1(.1)	0(0)	0(0)	.1(.6)	0(0)	0(0)	0(0)	0(0)
28 CARDAMINE PRATENSIS ANGUSTIFOLIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
29 CAREX AQUATILIS S.L.	0(0)	0(0)	0(0)	0(0)	17.1(1.0)	22.0(1.0)	42.5(1 0)	14.8(1.0)
30 CAREX ATROFUSCA	0(0)	0(0)	0(0)	0(0)	0(0)	2.5(.2)	.1(2)	2(.2)
31 CAREX BIGELOWII	0(0)	0(0)	18 2(1 0)	10.1(.7)	0(0)	1.7(.8)	0(0)	0(0)
33 CAREX MARINA	0(0)	0(0)	0(0)	0(0)	.1(.1)	.7(.3)	0(0)	.1(.2)
35 CAREX MEMBRANACEA	1(.4)	1(.1)	6.2(9)	4.7(7)	.1(.3)	0(0)	0(0)	0(0)
36 CAREX MISANDRA MISANDRA	.1(4)	.1(2)	.1(.1)	0(0)	.4(3)	.8(.4)	0(0)	0(0)
37 CAREX RARIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)
38 CAREX ROTUNDATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.6(.5)
39 CAREX RUPESTRIS	0(0)	4 8(1.0)	.1(.2)	0(0)	0(0)	0(0)	0(0)	0(0)
40 CAREX SAXATILIS LAXA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)	2.6(.7)
41 CAREX SCIRPOIDEA	0(0)	1.3(6)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
42 CAREX SUBSPATHACEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
44 CAREX VAGINATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)	0(0)
45 CAREX SP.	0(0)	2(.4)	.1(.1)	0(0)	0(0)	0(0)	.1(.1)	.3(.3)
46 CASSIOPE TETRAGONA TETRAGONA	.1(1)	0(0)	9(4)	2.6(1.0)	0(0)	0(0)	0(0)	0(0)
47 CERASTIUM BEERINGIANUM BEERINGIANUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
49 CHRYSANTHEMUM INTEGRIFOLIUM	4(9)	.3(7)	.1(2)	.1(.1)	0(0)	0(0)	0(0)	0(0)
51 COCHLEARIA OFFICINALIS ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
52 DESCHAMPSIA CAESPITOSA ORIENTALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
53 DRABA ALPINA	.1(.5)	1(4)	.3(.5)	.1(.5)	0(0)	0(0)	0(0)	0(0)
56 DRABA LACTEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
57 DRABA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
58 DRYAS INTEGRIFOLIA INTEGRIFOLIA	46.9(1 0)	53 5(1 0)	19 5(1.0)	20.6(1.0)	9.0(.9)	13.5(1.0)	.1(.2)	0(0)
59 DUPONTIA FISHERI S.L	0(0)	0(0)	0(0)	0(0)	0(0)	.2(.7)	.4(1 0)	0(0)
61 ELYMUS ARENARIUS MOLLIS VILLOSISSIMUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
62 EPILOBIUM LATIFOLIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
63 EQUISETUM ARVENSE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
64 EQUISETUM SCIRPOIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
65 EQUISETUM VARIEGATUM	0(0)	.1(.4)	.1(6)	0(0)	.1(.9)	2.0(.9)	.9(1.0)	.1(.5)
66 ERIGERON ERIOCEPHALUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
399 ERIOPHORUM ANGUSTIFOLIUM S L	2(4)	1(.2)	4.7(1.0)	7.9(1.0)	22.0(1 0)	15.0(1.0)	2 6(1 0)	11.9(1.0)
69 ERIOPHORUM RUSSEOLUM	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)	1(.2)	.9(.9)
70 ERIOPHORUM SCHEUCHZERI SCHEUCHZERI	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
72 ERIOPHORUM VAGINATUM	0(0)	0(0)	0(0)	9.5(1 0)	0(0)	0(0)	0(0)	0(0)
73 EUTREMA EDWARDSII	.1(1)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
74 FESTUCA BAFFINENSIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
76 FESTUCA RUBRA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
78 GENTIANELLA PROPINQUA PROPINQUA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
79 HIEROCHLOE PAUCIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)
83 JUNCUS BIGLUMIS	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)	.1(.2)	0(0)
84 JUNCUS CASTANEUS CASTANEUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
86 KOBRESIA MYOSUROIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
89 LESQUERELLA ARCTICA	1(1)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
90 LLOYDIA SEROTINA	0(0)	1(3)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
91 LUZULA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
92 LUZULA CONFUSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
94 MINUARTIA ARCTICA	1 9(9)	3(.7)	3(.9)	.1(.1)	0(0)	0(0)	0(0)	0(0)
96 MINUARTIA RUBELLA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
100 OXYTROPIS BOREALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
103 OXYTROPIS NIGRESCENS BRYOPHILA	1(1)	1 0(9)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
105 PAPAVER LAPPONICUM OCCIDENTALE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
106 PAPAVER MACOUNII	3(9)	1(.8)	.1(.6)	.1(.9)	0(0)	0(0)	0(0)	0(0)
108 PARRYA NUDICAULIS NUDICAULIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
109 PEDICULARIS CAPITATA	1 4(9)	1(.1)	0(0)	0(0)	0(0)	.1(1)	0(0)	0(0)
110 PEDICULARIS LANATA	1(2)	.2(.4)	1(2)	0(0)	0(0)	0(0)	0(0)	0(0)
112 PEDICULARIS SUDETICA INTERIOR	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
381 PEDICULARIS SUDETICA S L	0(0)	0(0)	0(0)	0(0)	1(.2)	.4(4)	9(1.0)	1.8(1.0)
114 PETASITES FRIGIDUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
117 POA ALPIGENA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
118 POA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
119 POA GLAUCA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
121 POA SP	3(9)	1(5)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
122 POLEMONIUM BOREALE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
124 POLYGONUM VIVIPARUM	7(1 0)	1(9)	0(0)	0(0)	.6(9)	7(.8)	.1(.2)	0(0)
127 POTENTILLA UNIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
129 PUCCINELLIA ANDERSONII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
130 PUCCINELLIA PHRYGANODES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
131 PYROLA GRANDIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
133 RANUNCULUS PALLASII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
134 RANUNCULUS PEDATIFIDUS AFFINIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
137 SAGINA INTERMEDIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
139 SALIX ARCTICA	1(2)	0(0)	8(7)	9(8)	4 0(1 0)	4 6(1 0)	.1(.7)	1(.2)
140 SALIX LANATA RICHARDSONII	0(0)	0(0)	0(0)	1(1)	1 2(5)	.5(.1)	1(2)	0(0)

Table B4 (cont'd). Raw species data for 1- × 10-m plots.
The units are percentage of cover, with frequency in parentheses.

	010A	010B	020B	0203	030B	0303	040A	040B
141 SALIX OVALIFOLIA OVALIFOLIA	3(.4)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)
142 SALIX PLANIFOLIA PULCHRA PULCHRA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
143 SALIX RETICULATA RETICULATA	1.1(1.0)	0(0)	4(.5)	.4(.9)	.3(.5)	9.4(1.0)	.1(.2)	0(0)
144 SALIX ROTUNDIFOLIA ROTUNDIFOLIA	.2(.4)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)	0(0)
145 SAUSSUREA ANGUSTIFOLIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
146 SAXIFRAGA CAESPITOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
147 SAXIFRAGA CERNUA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
148 SAXIFRAGA FOLIOLOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
149 SAXIFRAGA HIERACIFOLIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
150 SAXIFRAGA CIRCULUS PROPINQUA	0(0)	0(0)	1(1)	.1(1)	0(0)	.1(.3)	0(0)	.1(.1)
151 SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	12.3(1.0)	1.8(1.0)	.1(.6)	.1(.5)	0(0)	.1(.4)	0(0)	0(0)
154 SENECIO ATROPURPUREUS FRIGIDUS	.1(.3)	0(0)	.6(.9)	.2(1.0)	0(0)	0(0)	0(0)	0(0)
156 SENECIO RESEDIFOLIUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
157 SILENE ACAULIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
159 SILENE WAHLBERGELLA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)	.1(.1)
160 STELLARIA HUMIFUSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
161 STELLARIA LAETA	0(0)	.1(.1)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
164 TARAXACUM PHYMATOCARPUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
165 THALICTRUM ALPINUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
168 TRISETUM SPICATUM SPICATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
169 UTRICULARIA VULGARIS MACRORHIZA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
172 WILHELMSIA PHYSODES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
901 UNKNOWN MONOCOT	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
902 UNKNOWN DICOT	0(0)	0(0)	.2(.3)	.1(.2)	.1(.7)	0(0)	0(0)	0(0)
LIVERWORTS								
173 ANEURA PINGUIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
426 ANASTROPHYLLUM MINUTUM	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)	0(0)
175 BLEPHAROSTOMA TRICHOPHYLLUM BREVIRETE	0(0)	0(0)	0(0)	0(0)	.1(.4)	0(0)	0(0)	0(0)
397 CALYPOGEIA MUELLERIANA	0(0)	0(0)	0(0)	0(0)	.1(.3)	0(0)	0(0)	0(0)
460 GYMNOCOLEA INFLATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
441 HARPANTHUS FLOTOWIANUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
405 LOPHOZIA BINSTEADII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
433 LOPHOZIA HETEROCOLPA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
407 LOPHOZIA QUADRILOBA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
486 LOPHOZIA SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
182 PLAGIOCHILA ARCTICA	0(0)	.1(.8)	.1(.6)	.8(1.0)	0(0)	3.5(.6)	0(0)	0(0)
184 PTILIDIUM CILIARE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
185 RADULA PROLIFERA	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)	0(0)
406 SCAPANIA SIMMONSII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
188 UNKNOWN LEAFY LIVERWORTS	.1(.7)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
189 UNKNOWN THALLOID LIVERWORTS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
MOSSES								
192 AULACOMNIUM ACUMINATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
193 AULACOMNIUM PALUSTRE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
194 AULACOMNIUM TURGIDUM	0(0)	0(0)	.1(.1)	0(0)	.1(.1)	0(0)	0(0)	0(0)
448 BRACHYTHECIACEAE	0(0)	0(0)	0(0)	.1(.3)	0(0)	.8(.6)	0(0)	0(0)
432 BRACHYTHECIUM GROENLANDICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
196 BRACHYTHECIUM TURGIDUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
440 BRYUM ALGOVICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
199 BRYUM ARCTICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
205 BRYUM TENOTRICHUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
439 BRYUM TORTIFOLIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
206 BYRUM WRIGHTII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
383 BRYUM SP.	.1(.3)	.2(.7)	.1(.5)	0(0)	.1(.5)	.9(.4)	.1(.6)	.1(.2)
209 CALLIERGON RICHARDSONII ROBUSTUM	0(0)	0(0)	0(0)	0(0)	.7(.7)	1.2(.6)	1.8(.9)	5.0(.5)
212 CALLIERGON SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
213 CAMPYLIUM STELLATUM	.1(.2)	0(0)	.1(.1)	.7(.4)	13.0(.9)	15.0(.9)	4.1(.9)	0(0)
214 CATOSCOPIUM NIGRITUM	0(0)	0(0)	.1(.1)	.1(.1)	1.3(.8)	3.0(.4)	5.5(1.0)	0(0)
215 CERATODON PURPUREUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
216 CINCLIDIUM ARCTICUM	0(0)	0(0)	0(0)	1.5(.4)	0(0)	2.7(.4)	18.0(1.0)	.1(.2)
217 CINCLIDIUM LATIFOLIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.2(.5)	.2(.2)
411 CINCLIDIUM STYGIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
449 CINCLIDIUM SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
218 CIRRIPHYLLUM CIRROSUM	0(0)	0(0)	.1(.7)	0(0)	0(0)	0(0)	0(0)	0(0)
219 CRATONEURON ARCTICUM	0(0)	.1(.4)	.1(.8)	.1(.1)	2.5(.7)	.1(.7)	0(0)	0(0)
221 CTENIDIUM MOLLUSCUM	0(0)	0(0)	0(0)	4.7(1.0)	0(0)	0(0)	0(0)	0(0)
223 CYRTOMNIUM HYMENOPHYLLUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
227 DICRANUM ANGUSTUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
228 DICRANUM ELONGATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
390 DICRANUM SP.	2.5(.7)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
229 DIDYMODON ASPERIFOLIUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
230 DISTICHIUM CAPILLACEUM	2.8(.7)	1.2(.9)	7.0(1.0)	12.5(1.0)	5.8(.8)	11.8(1.0)	7.1(.9)	.1(.1)
232 DISTICHIUM INCLINATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
233 DITRICHUM FLEXICAULE	23.0(.9)	1.9(1.0)	36.0(1.0)	16.5(1.0)	1.0(.3)	2.5(.6)	0(0)	0(0)
236 DREPANOCLADUS BREVIFOLIUS	0(0)	0(0)	0(0)	0(0)	14.4(1.0)	9.0(.9)	28.8(1.0)	20.2(1.0)
237 DREPANOCLADUS REVOLVENS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
238 DREPANOCLADUS UNCINATUS	4.7(4)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
239 DREPANOCLADUS SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
240 ENCALYPTA ALPINA	2.9(1.0)	0(0)	1.3(.4)	.3(.6)	.1(7)	2.0(.4)	.1(.1)	0(0)
241 ENCALYPTA PROCERA	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)
244 ENCALYPTA SP.	4(.6)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)
246 FISSIDENS OSMUNDOIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
450 FISSIDENS SP.	0(0)	0(0)	0(0)	0(0)	.1(.2)	0(0)	0(0)	0(0)
247 FUNARIA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
250 HYLOCOMIUM SPLENDENS OBTUSIFOLIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
251 HYPNUM BAMBERGERI	0(0)	0(0)	8.9(1.0)	1.8(8)	0(0)	0(0)	0(0)	0(0)
252 HYPNUM CUPRESSIFORME	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
253 HYPNUM PROCERRIMUM	0(0)	.2(8)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
254 HYPNUM REVOLUTUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
256 HYPNUM SP.	0(0)	0(0)	4.0(1.0)	0(0)	4(.4)	.6(.3)	0(0)	0(0)
257 LEPTOBRYUM PYRIFORME	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
258 MEESIA TRIQUETRA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
259 MEESIA ULIGINOSA	0(0)	0(0)	.1(.1)	0(0)	1.6(8)	.2(3)	4.1(.9)	0(0)
444 MNIUM ANDREWSIANUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
260 MNIUM BLYTTII	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)
431 PLAGIOMNIUM ELLIPTICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
262 MYURELLA JULACEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
264 ONCOPHORUS WAHLENBERGII	0(0)	1(1)	0(0)	0(0)	.1(.3)	0(0)	0(0)	0(0)
265 ORTHOTHECIUM CHRYSEUM	0(0)	0(0)	.5(.2)	.1(7)	.5(5)	7.1(1.0)	6.0(.2)	0(0)
268 PHILONOTIS FONTANA PUMILA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
410 PLAGIOPUS OEDERIANA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
272 POGONATUM ALPINUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
446 POLYTRICHACEAE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table B4 (cont'd).

	010A	010B	020B	0203	030B	0303	040A	040B
275 POHLIA NUTANS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
404 POHLIA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
276 RHACOMITRIUM LANUGINOSUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
278 RHYTIDIUM RUGOSUM	4.0(.3)	.5(.4)	0(0)	3.5(.5)	0(0)	0(0)	0(0)	0(0)
279 SCORPIDIUM SCORPIOIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	27.2(.9)
280 SCORPIDIUM TURGESCENS	0(0)	0(0)	1(.1)	0(0)	0(0)	0(0)	0(0)	0(0)
282 SPLACHNUM VASCULOSUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
283 STEGONIA LATIFOLIA PILIFERA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
285 TETRAPLODON MNIOIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
287 THUIDIUM ABIETINUM	.1(.1)	.3(.9)	1(.1)	0(0)	0(0)	0(0)	0(0)	0(0)
288 TIMMIA AUSTRIACA	0(0)	0(0)	0(0)	0(0)	.1(.1)	.1(.3)	0(0)	0(0)
289 TIMMIA MEGAPOLITANA BAVARICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
290 TIMMIA NORVEGICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
291 TOMENTHYPNUM NITENS	1.3(.5)	2.6(.9)	25 5(1 0)	57.0(1.0)	12.2(.9)	11.5(1.0)	1.0(.1)	0(0)
292 TORTELLA ARCTICA	2.5(.2)	0(0)	.1(.1)	0(0)	.1(.2)	2.0(.3)	0(0)	0(0)
296 TORTULA RURALIS	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)	0(0)
298 VOLTIA HYPERBOREA	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)
503 UNKNOWN MOSS	1.3(.9)	.1(8)	.1(.1)	.3(.7)	1.8(.6)	.1(.8)	0(0)	0(0)
LICHENS								
299 ALECTORIA NIGRICANS	.1(2)	.3(.8)	.1(.3)	0(0)	0(0)	0(0)	0(0)	0(0)
300 ALECTORIA OCHROLEUCA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
307 CALOPLACA SP	1(1.0)	1(1 0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
310 CETRARIA CUCULLATA	.2(9)	.8(1.0)	.8(.9)	.5(.6)	0(0)	0(0)	0(0)	0(0)
311 CETRARIA DELISEI	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
312 CETRARIA ISLANDICA	8(1 0)	5(1 0)	2 4(.8)	3.1(1 0)	.1(.1)	1.6(.4)	0(0)	0(0)
314 CETRARIA NIVALIS	.1(.4)	.4(1.0)	1.1(.5)	.2(.4)	0(0)	0(0)	0(0)	0(0)
315 CETRARIA RICHARDSONII	1(.5)	.1(.1)	.1(.1)	.1(.3)	0(0)	0(0)	0(0)	0(0)
316 CETRARIA TILESII	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)	0(0)
385 CLADONIA GRACILIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
316 CLADONIA LEPIDOTA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
427 CLADONIA PHYLLOPHORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
319 CLADONIA POCILLUM	.1(5)	0(0)	3(.5)	1(.1)	0(0)	0(0)	0(0)	0(0)
320 CLADONIA SQUAMOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
322 CLADONIA SP	0(0)	.1(3)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
327 CORNICULARIA DIVERGENS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
328 DACTYLINA ARCTICA	5(1.0)	1(1.0)	.1(.4)	.1(.7)	0(0)	.2(.3)	0(0)	0(0)
329 DACTYLINA RAMULOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
330 EVERNIA PERFRAGILIS	0(0)	.8(1 0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
331 FULGENSIA BRACTEATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
332 GYALECTA FOVEOLARIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
334 HYPOGYMNIA SUBOBSCURA	0(0)	.9(.9)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
336 LECANORA EPIBRYON	7.6(1 0)	9.5(1 0)	.3(.6)	2(.3)	0(0)	0(0)	0(0)	0(0)
428 LECIDEA RAMULOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
339 LECIDEA VERNALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
393 LEPTOGIUM SINNUATUM	0(0)	0(0)	1(.1)	0(0)	0(0)	0(0)	0(0)	0(0)
342 LOPADIUM FECUNDUM	3 6(.9)	2.2(1.0)	.3(.2)	0(0)	0(0)	0(0)	0(0)	0(0)
343 OCHROLECHIA FRIGIDA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
413 OCHROLECHIA FRIGIDA THELEPHOROIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
348 PELTIGERA APHTHOSA	.1(.1)	0(0)	0(0)	.4(4)	0(0)	.1(.1)	0(0)	0(0)
349 PELTIGERA CANINA S L.	.1(.2)	1(.5)	.1(.2)	0(0)	0(0)	.1(.2)	0(0)	0(0)
353 PELTIGERA SPURIA SOREDIATA	2.1(.9)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
418 PERTUSARIA CORIACEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
358 PERTUSARIA DACTYLINA	'(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
364 PERTUSARIA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
360 PHYSCONIA MUSCIGENA	0(0)	.1(.4)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
412 PSOROMA HYPNORUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
400 SOLORINA SP.	0(0)	0(0)	1(.2)	.1(1)	0(0)	.1(.5)	0(0)	0(0)
369 SPHAEROPHORUS GLOBOSUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
370 STEREOCAULON ALPINUM	.1(.2)	.1(.1)	0(0)	.1(.2)	0(0)	0(0)	0(0)	0(0)
372 THAMNOLIA SUBULIFORMIS	.9(1.0)	2 7(1.0)	6 7(1 0)	6.0(9)	.1(.1)	0(0)	0(0)	0(0)
429 TONINIA CUMULATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
375 XANTHORIA ELEGANS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
403 UNKNOWN CRUSTOSE LICHEN	8.2(.9)	.8(.8)	0(0)	0(0)	0(0)	.5(.1)	0(0)	0(0)
378 UNKNOWN FRUTICOSE LICHEN	0(0)	1(.3)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0'
379 NOSTOC COMMUNE	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)	.2(.7)	.1(.9)
380 NOSTOC SP	0(0)	0(0)	1(.4)	.1(.3)	.1(.9)	0(0)	0(0)	0(0)

	050A	050B	060B	0901	0902	1001	1101	1102
VASCULAR PLANTS								
2 ALOPECURUS ALPINUS ALPINUS	0(0)	0(0)	0(0)	0(0)	.1(.2)	0(0)	0(0)	0(0)
3 ANDROSACE CHAMAEJASME LEHMANNIANA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
4 ANDROSACE SEPTENTRIONALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
5 ANEMONE PARVIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
6 ANEMONE RICHARDSONII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
9 ARCTAGROSTIS LATIFOLIA S.L	0(0)	0(0)	0(0)	0(0)	1.4(.9)	0(0)	0(0)	0(0)
10 ARCTOPHILA FULVA	0(0)	0(0)	24.5(1.0)	0(0)	0(0)	0(0)	0(0)	0(0)
12 ARMERIA MARITIMA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
13 ARTEMISIA ARCTICA ARCTICA	0(0)	0(0)	0(.)	0(0)	0(0)	0(0)	0(0)	0(0)
14 ARTEMISIA BOREALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
15 ARTEMISIA GLOMERATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
18 ASTRAGALUS ALPINUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
19 ASTRAGALUS UMBELLATUS	0(0)	0(0)	0(0)	.2(.4)	0(0)	.6(.7)	0(0)	.9(.9)
22 BRAYA PURPURASCENS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
23 BRAYA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.3)	0(0)
24 BROMUS PUMPELLIANUS ARCTICUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
25 CALTHA PALUSTRIS ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
27 CARDAMINE DIGITATA	0(0)	0(0)	0(0)	.1(.1)	.1(.4)	0(0)	0(0)	.1(.8)
28 CARDAMINE PRATENSIS ANGUSTIFOLIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
29 CAREX AQUATILIS S L.	43 7(1.0)	18 6(1.0)	1 0(2)	0(0)	7 7(.9)	0(0)	70 5(1 0)	0(0)
30 CAREX ATROFUSCA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
31 CAREX BIGELOWII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
33 CAREX MARINA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
35 CAREX MEMBRANACEA	0(0)	0(0)	0(0)	0(0)	1(2)	0(0)	0(0)	4.6(.8)
36 CAREX MISANDRA MISANDRA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)
37 CAREX RARIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
38 CAREX ROTUNDATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
39 CAREX RUPESTRIS	0(0)	0(0)	0(0)	3(3)	0(0)	6.5(1.0)	0(0)	.1(.5)
40 CAREX SAXATILIS LAXA	1 1(5)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
41 CAREX SCIRPOIDEA	0(0)	0(0)	0(0)	4 4(1 0)	0(0)	0(0)	0(0)	.6(.6)
42 CAREX SUBSPATHACEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
44 CAREX VAGINATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table B4 (cont'd). Raw species data for 1- × 10-m plots.

The units are percentage of cover, with frequency in parentheses.

		050A	050B	060B	0901	0902	1001	1101	1102
45	CAREX SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)
46	CASSIOPE TETRAGONA TETRAGONA	0(0)	0(0)	0(0)	20.8(1.0)	0(0)	1.7(.5)	0(0)	.1(.1)
47	CERASTIUM BEERINGIANUM BEERINGIANUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
49	CHRYSANTHEMUM INTEGRIFOLIUM	0(0)	0(0)	0(0)	.4(.9)	0(0)	0(0)	0(0)	.1(.9)
51	COCHLEARIA OFFICINALIS ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
52	DESCHAMPSIA CAESPITOSA ORIENTALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
53	DRABA ALPINA	0(0)	0(0)	0(0)	.1(2)	0(0)	.1(.2)	0(0)	.1(.4)
56	DRABA LACTEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
57	DRABA SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
58	DRYAS INTEGRIFOLIA INTEGRIFOLIA	0(0)	0(0)	0(0)	24.6(1.0)	8(.6)	33 9(1.0)	0(0)	44.2(1.0)
59	DUPONTIA FISHERI S.L.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
61	ELYMUS ARENARIUS MOLLIS VILLOSISSIMUS	0(0)	0(0)	0(0)	0)	0(0)	0(0)	0(0)	0(0)
62	EPILOBIUM LATIFOLIUM	0(0)	0(0)	0(0)	0)	0(0)	0(0)	0(0)	0(0)
63	EQUISETUM ARVENSE	0(0)	0(0)	0(0)	.1(1)	26.7(1.0)	0(0)	0(0)	0(0)
64	EQUISETUM SCIRPOIDES	0(0)	0(0)	0(0)	0(0)	3.8(1.0)	0(0)	0(0)	0(0)
65	EQUISETUM VARIEGATUM	0(0)	0(0)	0(0)	.6(1 0)	0(0)	0(0)	1 2(1 0)	.1(.2)
66	ERIGERON ERIOCEPHALUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
399	ERIOPHORUM ANGUSTIFOLIUM S.L.	6 1(1.0)	.4(1.0)	0(0)	0(0)	4 6(1.0)	0(0)	6.9(1.0)	0(0)
69	ERIOPHORUM RUSSEOLUM	0(0)	.6(1.0)	0(0)	0(0)	0(0)	0(0)	1.2(6)	0(0)
70	ERIOPHORUM SCHEUCHZERI SCHEUCHZERI	.1(1.0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
72	ERIOPHORUM VAGINATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
73	EUTREMA EDWARDSII	0(0)	0(0)	0(0)	0(0)	.1(.2)	0(0)	0(0)	.1(.1)
74	FESTUCA BAFFINENSIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
76	FESTUCA RUBRA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
78	GENTIANELLA PROPINQUA PROPINQUA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
79	HIEROCHLOE PAUCIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
83	JUNCUS BIGLUMIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)	.1(.1)
84	JUNCUS CASTANEUS CASTANEUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
86	KOBRESIA MYOSUROIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
89	LESQUERELLA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
90	LLOYDIA SEROTINA	0(0)	0(0)	0(0)	.1(.9)	0(0)	0(0)	0(0)	.1(.5)
91	LUZULA ARCTICA	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)	0(0)
92	LUZULA CONFUSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
94	MINUARTIA ARCTICA	0(0)	0(0)	0(0)	.1(.4)	.2(.1)	.1(.2)	0(0)	.3(.8)
96	MINUARTIA RUBELLA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
100	OXYTROPIS BOREALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
103	OXYTROPIS NIGRESCENS BRYOPHILA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
105	PAPAVER LAPPONICUM OCCIDENTALE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
106	PAPAVER MACOUNII	0(0)	0(0)	0(0)	.3(.6)	0(0)	.1(.3)	0(0)	.5(.8)
108	PARRYA NUDICAULIS NUDICAULIS	0(0)	0(0)	0(0)	.1(.4)	0(0)	0(0)	0(0)	.1(.3)
109	PEDICULARIS CAPITATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)
110	PEDICULARIS LANATA	0(0)	0(0)	0(0)	.2(.4)	0(0)	.1(.4)	0(0)	0(0)
112	PEDICULARIS SUDETICA INTERIOR	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
381	PEDICULARIS SUDETICA S L.	1(.1)	0(0)	0(0)	0(0)	.1(.1)	0(0)	1.1(1.0)	0(0)
114	PETASITES FRIGIDUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
117	POA ALPIGENA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
118	POA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
119	POA GLAUCA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
121	POA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
122	POLEMONIUM BOREALE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
124	POLYGONUM VIVIPARUM	0(0)	0(0)	0(0)	.1(.9)	.6(.9)	0(0)	.2(1.0)	.1(.1)
127	POTENTILLA UNIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
129	PUCCINELLIA ANDERSONII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
130	PUCCINELLIA PHRYGANODES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
131	PYROLA GRANDIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
133	RANUNCULUS PALLASII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
134	RANUNCULUS PEDATIFIDUS AFFINIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
137	SAGINA INTERMEDIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
139	SALIX ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	4.6(1.0)	1.0(.3)
140	SALIX LANATA RICHARDSONII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1 0(.7)	0(0)
141	SALIX OVALIFOLIA OVALIFOLIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
142	SALIX PLANIFOLIA PULCHRA PULCHRA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
143	SALIX RETICULATA RETICULATA	0(0)	0(0)	0(0)	.7(.8)	10 8(1.0)	0(0)	.1(.2)	1.5(.9)
144	SALIX ROTUNDIFOLIA ROTUNDIFOLIA	0(0)	0(0)	0(0)	6.3(1.0)	.6(.6)	0(0)	.2(.1)	5.6(1.0)
145	SAUSSUREA ANGUSTIFOLIA	0(0)	0(0)	0(0)	.1(.2)	0(0)	0(0)	0(0)	0(0)
146	SAXIFRAGA CAESPITOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
147	SAXIFRAGA CERNUA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
148	SAXIFRAGA FOLIOLOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
149	SAXIFRAGA HIERACIFOLIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
150	SAXIFRAGA HIRCULUS PROPINQUA	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)	8(.9)	0(0)
151	SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	0(0)	0(0)	0(0)	1.3(.9)	0(0)	2.1(1.0)	.1(.1)	1.6(1.0)
154	SENECIO ATROPURPUREUS FRIGIDUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.6(1.0)
156	SENECIO RESEDIFOLIUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.2(.5)
157	SILENE ACAULIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
159	SILENE WAHLBERGELLA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
160	STELLARIA HUMIFUSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
161	STELLARIA LAETA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)
164	TARAXACUM PHYMATOCARPUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
165	THALICTRUM ALPINUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.3(.7)	0(0)
168	TRISETUM SPICATUM SPICATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
169	UTRICULARIA VULGARIS MACRORHIZA	0(0)	0(0)	.1(3)	0(0)	0(0)	0(0)	0(0)	0(0)
172	WILHELMSIA PHYSODES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
901	UNKNOWN MONOCOT	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
902	UNKNOWN DICOT	0(0)	0(0)	0(0)	.1(1)	0(0)	0(0)	9(.7)	.1(.3)
	LIVERWORTS								
173	ANEURA PINGUIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
426	ANASTROPHYLLUM MINUTUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
175	BLEPHAROSTOMA TRICHOPHYLLUM BREVIRETE	0(0)	0(0)	0(0)	.1(.3)	1 0(.7)	0(0)	0(0)	0(0)
397	CALYPOGEIA MUELLERIANA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
460	GYMNOCOLEA INFLATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
441	HARPANTHUS FLOTOWIANUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
405	LOPHOZIA BINSTEADII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
433	LOPHOZIA HETEROCOLPA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
407	LOPHOZIA QUADRILOBA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
486	LOPHOZIA SP	0(0)	0(0)	0(0)	0(0)	2(6)	0(0)	0(0)	.1(.5)
182	PLAGIOCHILA ARCTICA	0(0)	0(0)	0(0)	.1(2)	8 0(8)	0(0)	0(0)	.1(.2)
181	PTILIDIUM CILIARE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
185	RADULA PROLIFERA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
406	SCAPANIA SIMMONSII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
188	UNKNOWN LEAFY LIVERWORTS	0(0)	0(0)	0(0)	0(0)	5.5(8)	0(0)	.1(3)	0(0)
189	UNKNOWN THALLOID LIVERWORTS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table B4 (cont'd).

	050A	050B	060B	0901	0902	1001	1101	1102
MOSSES								
192 AULACOMNIUM ACUMINATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
193 AULACOMNIUM PALUSTRE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
194 AULACOMNIUM TURGIDUM	0(0)	0(0)	0(0)	0(0)	.2(.3)	0(0)	0(0)	0(0)
448 BRACHYTHECIACEAE	0(0)	0(0)	0(0)	0(0)	.4(.6)	0(0)	0(0)	0(0)
432 BRACHYTHECIUM GROENLANDICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
196 BRACHYTHECIUM TURGIDUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
440 BRYUM ALGOVICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
199 BRYUM ARCTICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
205 BRYUM STENOTRICHUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
439 BRYUM TORTIFOLIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
206 BYRUM WRIGHTII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
383 BRYUM SP.	0(0)	0(0)	0(0)	.1(.1)	.1(.2)	.1(.1)	.1(.1)	.1(.1)
209 CALLIERGON RICHARDSONII ROBUSTUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.6(.8)	0(0)
212 CALLIERGON SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
213 CAMPYLIUM STELLATUM	0(0)	0(0)	0(0)	.1(.1)	1.5(.5)	0(0)	1.9(1.0)	.1(.3)
214 CATOSCOPIUM NIGRITUM	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)
215 CERATODON PURPUREUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
216 CINCLIDIUM ARCTICUM	0(0)	0(0)	0(0)	0(0)	.8(.4)	0(0)	0(0)	0(0)
217 CINCLIDIUM LATIFOLIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	2.8(1.0)	0(0)
411 CINCLIDIUM STYGIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
449 CINCLIDIUM SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
218 CIRRIPHYLLUM CIRROSUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
219 CRATONEURON ARCTICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
221 CTENIDIUM MOLLUSCUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
223 CYRTOMNIUM HYMENOPHYLLUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
227 DICRANUM ANGUSTUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
228 DICRANUM ELONGATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
390 DICRANUM SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
229 DIDYMODON ASPERIFOLIUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	13.5(1.0)
230 DISTICHIUM CAPILLACEUM	0(0)	0(0)	0(0)	2.2(.5)	15.5(9)	.1(.3)	2.8(.9)	9.5(1.0)
232 DISTICHIUM INCLINATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
233 DITRICHUM FLEXICAULE	0(0)	0(0)	0(0)	21.6(1.0)	16.0(.7)	1.3(1 0)	.2(1)	34.5(1.0)
236 DREPANOCLADUS BREVIFOLIUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	4.1(1.0)	0(0)
237 DREPANOCLADUS REVOLVENS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
238 DREPANOCLADUS UNCINATUS	0(0)	0(0)	0(0)	0(0)	4.7(.8)	.9(9)	0(0)	6.0(.9)
239 DREPANOCLADUS SP.	0(0)	0(0)	0(0)	2.6(8)	0(0)	0(0)	0(0)	0(0)
240 ENCALYPTA ALPINA	0(0)	0(0)	0(0)	.1(.7)	1.4(8)	0(0)	.3(.6)	.1(.6)
241 ENCALYPTA PROCERA	0(0)	0(0)	0(0)	.1(.2)	.1(.2)	0(0)	0(0)	0(0)
244 ENCALYPTA SP.	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.3)	0(0)	0(0)
246 FISSIDENS OSMUNDOIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
450 FISSIDENS SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
247 FUNARIA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
250 HYLOCOMIUM SPLENDENS OBTUSIFOLIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
251 HYPNUM BAMBERGERI	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
252 HYPNUM CUPRESSIFORME	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
253 HYPNUM PROCERRIMUM	0(0)	0(0)	0(0)	2.8(.7)	0(0)	1.1(.6)	0(0)	.2(.7)
254 HYPNUM REVOLUTUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	5.0(1.0)
256 HYPNUM SP	0(0)	0(0)	0(0)	0(0)	.1(.3)	0(0)	0(0)	0(0)
257 LEPTOBRYUM PYRIFORME	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
258 MEESIA TRIQUETRA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	5.0(.9)	0(0)
259 MEESIA ULIGINOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
444 MNIUM ANDREWSIANUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
260 MNIUM BLYTTII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
431 PLAGIOMNIUM ELLIPTICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
262 MYURELLA JULACEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
264 ONCOPHORUS WAHLENBERGII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.3)	0(0)
265 ORTHOTHECIUM CHRYSEUM	0(0)	0(0)	0(0)	0(0)	.1( )	0(0)	.1(.6)	.1(.4)
268 PHILONOTIS FONTANA PUMILA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
410 PLAGIOPUS OEDERIANA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
272 POGONATUM ALPINUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
446 POLYTRICHACEAE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
275 POHLIA NUTANS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
404 POHLIA SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
276 RHACOMITRIUM LANUGINOSUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
278 RHYTIDIUM RUGOSUM	0(0)	0(0)	0(0)	.1(.5)	0(0)	.1(.1)	0(0)	0(0)
279 SCORPIDIUM SCORPIOIDES	19.5(1.0)	32.5(1.0)	1.5(.3)	0 0)	0(0)	0(0)	0(0)	0(0)
280 SCORPIDIUM TURGESCENS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
282 SPLACHNUM VASCULOSUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
283 STEGONIA LATIFOLIA PILIFERA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
285 TETRAPLODON MNIOIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
287 THUIDIUM ABIETINUM	0(0)	0(0)	0(0)	2.0(.8)	0(0)	.1(.3)	0(0)	0(0)
288 TIMMIA AUSTRIACA	0(0)	0(0)	0(0)	.1(.6)	0(0)	0(0)	0(0)	0(0)
289 TIMMIA MEGAPOLITANA BAVARICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
290 TIMMIA NORVEGICA	0(0)	0(0)	0(0)	0(0)	.5(.5)	0(0)	0(0)	0(0)
291 TOMENTHYPNUM NITENS	0(0)	0(0)	0(0)	5.1(.9)	22.0(.9)	3.2(1.0)	0(0)	19.8(1.0)
292 TORTELLA ARCTICA	0(0)	0(0)	0(0)	0(0)	1.5(.4)	0(0)	0(0)	1.5(.2)
296 TORTULA RURALIS	0(0)	0(0)	0(0)	1.3(.5)	0(0)	0(0)	0(0)	3.9(1.0)
298 VOITIA HYPERBOREA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
903 UNKNOWN MOSS	0(0)	0(0)	0(0)	.1(.8)	1.0(.5)	.1(5)	.1(.1)	.1(.2)
LICHENS								
299 ALECTORIA NIGRICANS	0(0)	0(0)	0(0)	0(0)	0(0)	.1(9)	0(0)	0(0)
300 ALECTORIA OCHROLEUCA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
307 CALOPLACA SP.	0(0)	0(0)	0(0)	0(0)	0(0)	1(.9)	0(0)	0(0)
310 CETRARIA CUCULLATA	0(0)	0(0)	0(0)	0(0)	0(0)	.6(1 0)	0(0)	1(.1)
311 CETRARIA DELISEI	0(0)	0(0)	0(0)	.5(.4)	0(0)	0(0)	0(0)	.1(1)
312 CETRARIA ISLANDICA	0(0)	0(0)	0(0)	1.3(5)	0(0)	.4(.8)	0(0)	0(0)
314 CETRARIA NIVALIS	0(0)	0(0)	0(0)	.1(4)	0(0)	2.1(1.0)	0(0)	0(0)
315 CETRARIA RICHARDSONII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
316 CETRARIA TILESII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
385 CLADONIA GRACILIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
318 CLADONIA LEPIDOTA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
427 CLADONIA PHYLLOPHORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
319 CLADONIA POCILLUM	0(0)	0(0)	0(0)	0(0)	0(0)	.1(7)	0(0)	0(0)
320 CLADONIA SQUAMOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
322 CLADONIA SP	0(0)	0(0)	0(0)	1(4)	.1(1)	0(0)	0(0)	0(0)
327 CORNICULARIA DIVERGENS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
328 DACTYLINA ARCTICA	0(0)	0(0)	0(0)	.9(6)	0(0)	.2(8)	0(0)	0(0)
329 DACTYLINA RAMULOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
330 EVERNIA PERFRAGILIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
331 FULGENSIA BRACTEATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
332 GYALECTA FOVEOLARIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
334 HYPOGYMNIA SUBOBSCURA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
336 LECANORA EPIBRYON	0(0)	0(0)	0(0)	0(0)	0(0)	1.6(1 0)	0(0)	0(0)

Table B4 (cont'd). Raw species data for 1- × 10-m plots.
The units are percentage of cover, with frequency in parentheses.

	050A	050B	060B	0901	0902	1001	1101	1102
428 LECIDEA RAMULOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
339 LECIDEA VERNALIS	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)
393 LEPTOGIUM SINNUATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
342 LOPADIUM FECUNDUM	0(0)	0(0)	0(0)	.2(5)	0(0)	1.7(.9)	0(0)	0(0)
343 OCHROLECHIA FRIGIDA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
413 OCHROLECHIA FRIGIDA THELEPHOROIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
348 PELTIGERA APHTHOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
349 PELTIGERA CANINA S.L.	0(0)	0(0)	0(0)	.1(4)	.1(.1)	0(0)	0(0)	0(0)
353 PELTIGERA SPURIA SOREDIATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
418 PERTUSARIA CORIACEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
358 PERTUSARIA DACTYLINA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
384 PERTUSARIA SP	0(0)	0(0)	0(0)	0(0)	0(0)	.3(.5)	0(0)	0(0)
360 PHYSCONIA MUSCIGENA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
412 PSOROMA HYPNORUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
400 SOLORINA SP.	0(0)	0(0)	0(0)	.1(1)	0(0)	.1(.1)	0(0)	0(0)
369 SPHAEROPHORUS GLOBOSUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
370 STEREOCAULON ALPINUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
372 THAMNOLIA SUBULIFORMIS	0(0)	0(0)	0(0)	.1(.4)	0(0)	3.8(1.0)	0(0)	0(0)
429 TONINIA CUMULATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
375 XANTHORIA ELEGANS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
403 UNKNOWN CRUSTOSE LICHEN	0(0)	0(0)	0(0)	.3(.3)	0(0)	.3(5)	0(0)	0(0)
378 UNKNOWN FRUTICOSE LICHEN	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)	0(0)	0(0)
379 NOSTOC COMMUNE	2.0(.6)	1.1(1.0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
380 NOSTOC SP.	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)

	1201	1205	1206	1207	1208	1209	1210	1305
VASCULAR PLANTS								
2 ALOPECURUS ALPINUS ALPINUS	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)	0(0)
3 ANDROSACE CHAMAEJASME LEHMANNIANA	0(0)	0(0)	0(0)	.1(2)	.4(1.0)	0(0)	0(0)	0(0)
4 ANDROSACE SEPTENTRIONALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
5 ANEMONE PARVIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
6 ANEMONE RICHARDSONII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
9 ARCTAGROSTIS LATIFOLIA S.L.	0(0)	0(0)	0(0)	.1(.2)	0(0)	0(0)	.1(.1)	.3(.6)
10 ARCTOPHILA FULVA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
12 ARMERIA MARITIMA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
13 ARTEMISIA ARCTICA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
14 ARTEMISIA BOREALIS	0(0)	0(0)	0(0)	2.9(1.0)	2.4(1.0)	0(0)	0(0)	0(0)
15 ARTEMISIA GLOMERATA	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)
18 ASTRAGALUS ALPINUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
19 ASTRAGULUS UMBELLATUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
22 BRAYA PURPURASCENS	0(0)	0(0)	0(0)	0(0)	.1(.9)	0(0)	0(0)	0(0)
23 BRAYA SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)
24 BROMUS PUMPELLIANUS ARCTICUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
25 CALTHA PALUSTRIS ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
27 CARDAMINE DIGITATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
28 CARDAMINE PRATENSIS ANGUSTIFOLIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
29 CAREX AQUATILIS S.L.	0(0)	28 6(1.0)	0(0)	0(0)	0(0)	38.0(1.0)	24 5(1.0)	0(0)
30 CAREX ATROFUSCA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
31 CAREX BIGELOWII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
33 CAREX MARINA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
35 CAREX MEMBRANACEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
36 CAREX MISANDRA MISANDRA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
37 CAREX RARIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
38 CAREX ROTUNDATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
39 CAREX RUPESTRIS	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)	.1(.2)
40 CAREX SAXATILIS LAXA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
41 CAREX SCIRPOIDEA	0(0)	0(0)	0(0)	.1(.2)	0(0)	0(0)	0(0)	0(0)
42 CAREX SUBSPATHACEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
44 CAREX VAGINATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
45 CAREX SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
46 CASSIOPE TETRAGONA TETRAGONA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
47 CERASTIUM BEERINGIANUM BEERINGIANUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
49 CHRYSANTHEMUM INTEGRIFOLIUM	0(0)	0(0)	0(0)	.3(.5)	.1(.4)	0(0)	0(0)	0(0)
51 COCHLEARIA OFFICINALIS ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
52 DESCHAMPSIA CAESPITOSA ORIENTALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
53 DRABA ALPINA	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)
56 DRABA LACTEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.6(.5)
57 DRABA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
58 DRYAS INTEGRIFOLIA INTEGRIFOLIA	0(0)	.1(.1)	0(0)	38.0(1.0)	0(0)	0(0)	7 8(1.0)	0(0)
59 DUPONTIA FISHERI S.L	1(1.0)	.9(1.0)	0(0)	0(0)	0(0)	8.2(1.0)	0(0)	0(0)
61 ELYMUS ARENARIUS MOLLIS VILLOSISSIMUS	3.3(1.0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
62 EPILOBIUM LATIFOLIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
63 EQUISETUM ARVENSE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
64 EQUISETUM SCIRPOIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
65 EQUISETUM VARIEGATUM	0(0)	12 9(1.0)	0(0)	0(0)	0(0)	0(0)	.2(1.0)	0(0)
66 ERIGERON ERIOCEPHALUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
399 ERIOPHORUM ANGUSTIFOLIUM S.L.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(3)	0(0)
69 ERIOPHORUM RUSSEOLUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
70 ERIOPHORUM SCHEUCHZERI SCHEUCHZERI	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
72 ERIOPHORUM VAGINATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
73 EUTREMA EDWARDSII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
74 FESTUCA BAFFINENSIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.4(.3)
76 FESTUCA RUBRA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
78 GENTIANELLA PROPINQUA PROPINQUA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
79 HIEROCHLOE PAUCIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
83 JUNCUS BIGLUMIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
84 JUNCUS CASTANEUS CASTANEUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
86 KOBRESIA MYOSUROIDES	0(0)	0(0)	0(0)	1.7(9)	0(0)	0(0)	0(0)	0(0)
89 LESQUERELLA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
90 LLOYDIA SEROTINA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
91 LUZULA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.3)
92 LUZULA CONFUSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
94 MINUARTIA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
96 MINUARTIA RUBELLA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
100 OXYTROPIS BOREALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
103 OXYTROPIS NIGRESCENS BRYOPHILA	0(0)	0(0)	0(0)	.1(4)	0(0)	0(0)	0(0)	0(0)
105 PAPAVER LAPPONICUM OCCIDENTALE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
106 PAPAVER MACOUNII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
108 PARRYA NUDICAULIS NUDICAULIS	0(0)	0(0)	0(0)	.1(2)	1(4)	0(0)	0(0)	0(0)
109 PEDICULARIS CAPITATA	0(0)	0(0)	0(0)	.3(.9)	1(2)	0(0)	.1(.9)	0(0)

Table B4 (cont'd).

	1201	1205	1206	1207	1208	1209	1210	1305
110 PEDICULARIS LANATA	0(0)	0(0)	0(0)	0(0)	.1(.2)	0(0)	0(0)	0(0)
112 PEDICULARIS SUDETICA INTERIOR	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
381 PEDICULARIS SUDETICA S.L.	0(0)	.2(.8)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
114 *PETASITES FRIGIDUS*	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
117 POA ALPIGENA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
118 POA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	2.8(.8)
119 POA GLAUCA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
121 POA SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
122 POLEMONIUM BOREALE	.1(.2)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
124 POLYGONUM VIVIPARUM	0(0)	.1(.4)	0(0)	1.5(1.0)	.1(.3)	0(0)	1.2(.8)	0(0)
127 POTENTILLA UNIFLORA	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)
129 PUCCINELLIA ANDERSONII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
130 PUCCINELLIA PHRYGANODES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
131 PYROLA GRANDIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
133 RANUNCULUS PALLASII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
134 RANUNCULUS PEDATIFIDUS AFFINIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
137 SAGINA INTERMEDIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
139 SALIX ARCTICA	0(0)	.1(.8)	0(0)	.3(.2)	0(0)	0(0)	.1(.2)	.1(.3)
140 SALIX LANATA RICHARDSONII	0(0)	.1(.4)	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)
141 SALIX OVALIFOLIA OVALIFOLIA	0(0)	.1(1.0)	0(0)	.6(.9)	10.9(1.0)	1.8(.8)	.8(.9)	0(0)
142 SALIX PLANIFOLIA *PULCHRA PULCHRA*	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	2.2(.7)
143 SALIX RETICULATA RETICULATA	0(0)	0(0)	0(0)	.4(.1)	0(0)	0(0)	.1(.4)	.1(.3)
144 SALIX ROTUNDIFOLIA ROTUNDIFOLIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	14.0(1.0)
145 SAUSSUREA ANGUSTIFOLIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
146 SAXIFRAGA CAESPITOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
147 SAXIFRAGA CERNUA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
148 SAXIFRAGA FOLIOLOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
149 SAXIFRAGA HIERACIFOLIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
150 SAXIFRAGA HIRCULUS PROPINQUA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)
151 SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	0(0)	0(0)	0(0)	.4(.3)	0(0)	0(0)	0(0)	0(0)
154 SENECIO ATROPURPUREUS FRIGIDUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)
156 SENECIO RESEDIFOLIUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
157 SILENE ACAULIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
159 SILENE WAHLBERGELLA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
160 STELLARIA HUMIFUSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
161 STELLARIA LAETA	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.6)	.3(.2)	.5(.9)
164 TARAXACUM PHYMATOCARPUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
165 THALICTRUM ALPINUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
168 TRISETUM SPICATUM SPICATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
169 UTRICULARIA VULGARIS MACRORHIZA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
172 WILHELMSIA PHYSODES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
901 UNKNOWN MONOCOT	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
902 UNKNOWN DICOT	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
LIVERWORTS								
173 ANEURA PINGUIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
426 ANASTROPHYLLUM MINUTUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
175 BLEPHAROSTOMA TRICHOPHYLLUM BREVIRETE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
397 CALYPOGEIA MUELLERIANA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
460 GYMNOCOLEA INFLATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
411 HARPANTHUS FLOTOWIANUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
405 LOPHOZIA BINSTEADII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
433 LOPHOZIA HETEROCOLPA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
407 LOPHOZIA QUADRILOBA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
486 LOPHOZIA SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
182 PLAGIOCHILA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
184 PTILIDIUM CILIARE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
185 RADULA PROLIFERA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
406 SCAPANIA SIMMONSII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
188 UNKNOWN LEAFY LIVERWORTS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
189 UNKNOWN THALLOID LIVERWORTS	0(0)	2.2(1.0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)
MOSSES								
192 AULACOMNIUM ACUMINATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
193 AULACOMNIUM PALUSTRE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)
194 AULACOMNIUM TURGIDUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
448 BRACHYTHECIACEAE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
432 BRACHYTHECIUM GROENLANDICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
196 BRACHYTHECIUM TURGIDUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
440 BRYUM ALGOVICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
199 BRYUM ARCTICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
205 BRYUM STENOTRICHUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
439 BRYUM TORTIFOLIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
206 BYRUM WRIGHTII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
383 BRYUM SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)	.1(.1)
209 CALLIERGON RICHARDSONII ROBUSTUM	0(0)	2.0(1.0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
212 CALLIERGON SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)
213 CAMPYLIUM STELLATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.4)	0(0)
214 CATOSCOPIUM NIGRITUM	0(0)	14.0(1.0)	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)
215 CERATODON PURPUREUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
216 CINCLIDIUM ARCTICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
217 CINCLIDIUM LATIFOLIUM	0(0)	45.5(1.0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
411 CINCLIDIUM STYGIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
449 CINCLIDIUM SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
218 CIRRIPHYLLUM CIRROSUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
219 CRATONEURON ARCTICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
221 CTENIDIUM MOLLUSCUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
223 *CYRTOMNIUM HYMENOPHYLLUM*	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
227 DICRANUM ANGUSTUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.4)
228 DICRANUM ELONGATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.7(.6)
390 DICRANUM SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
229 DIDYMODON ASPERIFOLIUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
230 DISTICHIUM CAPILLACEUM	0(0)	12.4(1.0)	0(0)	0(0)	0(0)	0(0)	.1(.6)	0(0)
232 DISTICHIUM INCLINATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
233 DITRICHUM FLEXICAULE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
236 DREPANOCLADUS BREVIFOLIUS	0(0)	15.5(1.0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
237 DREPANOCLADUS REVOLVENS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
238 DREPANOCLADUS UNCINATUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
239 DREPANOCLADUS SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
240 ENCALYPTA ALPINA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
241 ENCALYPTA PROCERA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
244 ENCALYPTA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)	0(0)
246 FISSIDENS OSMUNDOIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
450 FISSIDENS SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table B4 (cont'd). Raw species data for 1- × 10-m plots.
The units are percentage of cover, with frequency in parentheses.

	1201	1205	1206	1207	1208	1209	1210	1305
247 FUNARIA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
250 HYLOCOMIUM SPLENDENS OBTUSIFOLIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
251 HYPNUM BAMBERGERI	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
252 HYPNUM CUPRESSIFORME	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
253 HYPNUM PROCERRIMUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
254 HYPNUM REVOLUTUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
256 HYPNUM SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
257 LEPTOBRYUM PYRIFORME	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
258 MEESIA TRIQUETRA	0(0)	.6(1.0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
259 MEESIA ULIGINOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
444 MNIUM ANDREWSIANUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
260 MNIUM BLYTTII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)
431 PLAGIOMNIUM ELLIPTICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
262 MYURELLA JULACEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
264 ONCOPHORUS WAHLENBERGII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.3)
265 ORTHOTHECIUM CHRYSEUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
268 PHILONOTIS FONTANA PUMILA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
410 PLAGIOPUS OEDERIANA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
272 POGONATUM ALPINUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)
446 POLYTRICHACEAE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
275 POHLIA NUTANS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)
401 POHLIA SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
276 RHACOMITRIUM LANUGINOSUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
278 RHYTIDIUM RUGOSUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
279 SCORPIDIUM SCORPIOIDES	0(0)	0(0)	100.0(1.0)	0(0)	0(0)	0(0)	0(0)	0(0)
280 SCORPIDIUM TURGESCENS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
282 SPLACHNUM VASCULOSUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
283 STEGONIA LATIFOLIA PILIFERA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
285 TETRAPLODON MNIOIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)
287 THUIDIUM ABIETINUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
288 TIMMIA AUSTRIACA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
289 TIMMIA MEGAPOLITANA BAVARICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
290 TIMMIA NORVEGICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
291 TOMENTHYPNUM NITENS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
292 TORTELLA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
296 TORTULA RURALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
298 VOITIA HYPERBOREA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
903 UNKNOWN MOSS	0(0)	.1(.1)	0(0)	.4(.6)	0(0)	0(0)	0(0)	.1(.1)
LICHENS								
299 ALECTORIA NIGRICANS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.3)
300 ALECTORIA OCHROLEUCA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
307 CALOPLACA SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
310 CETRARIA CUCULLATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.3)
311 CETRARIA DELISEI	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
312 CETRARIA ISLANDICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.3(.7)
314 CETRARIA NIVALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)
315 CETRARIA RICHARDSONII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
316 CETRARIA TILESII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
385 CLADONIA GRACILIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(4)
318 CLADONIA LEPIDOTA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
427 CLADONIA PHYLLOPHORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
319 CLADONIA POCILLUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.4(.6)
320 CLADONIA SQUAMOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
322 CLADONIA SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.6)
327 CORNICULARIA DIVERGENS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
328 DACTYLINA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.2(.8)
329 DACTYLINA RAMULOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
330 EVERNIA PERFRAGILIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
331 FULGENSIA BRACTEATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
332 GYALECTA FOVEOLARIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)
334 HYPOGYMNIA SUBOBSCURA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.7)
336 LECANORA EPIBRYON	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	4.1(.9)
423 LECIDEA RAMULOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
339 LECIDEA VERNALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.3)
393 LEPTOGIUM SINNUATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
342 LOPADIUM FECUNDUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
343 OCHROLECHIA FRIGIDA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)
413 OCHROLECHIA FRIGIDA THELEPHOROIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)
348 PELTIGERA APHTHOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
349 PELTIGERA CANINA S.L.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
353 PELTIGERA SPURIA SOREDIATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
418 PERTUSARIA CORIACEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
358 PERTUSARIA DACTYLINA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
384 PERTUSARIA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
360 PHYSCONIA MUSCIGENA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
412 PSORONA HYPNORUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
400 SOLORINA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
369 SPHAEROPHORUS GLOBOSUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)
370 STEREOCAULON ALPINUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
372 THAMNOLIA SUBULIFORMIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.9)
429 TONINIA CUMULATA	0(0)	0(0)	0(0)	1.3(.9)	0(0)	0(0)	0(0)	0(0)
375 XANTHORIA ELEGANS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
403 UNKNOWN CRUSTOSE LICHEN	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	18.0(.9)
378 UNKNOWN FRUTICOSE LICHEN	0(0)	0(0)	0(0)	0(0)	4.9(1.0)	0(0)	0(0)	0(0)
379 NOSTOC COMMUNE	0(0)	.8(.4)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
380 NOSTOC SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

	1309	1310	1311	1312	1313	1318	1401	1402
VASCULAR PLANTS								
2 ALOPECURUS ALPINUS ALPINUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
3 ANDROSACE CHAMAEJASME LEHMANNIANA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
4 ANDROSACE SEPTENTRIONALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
5 ANEMONE PARVIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
6 ANEMONE RICHARDSONII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
9 ARCTAGROSTIS LATIFOLIA S.L.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
10 ARCTOPHILA FULVA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
12 ARMERIA MARITIMA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
13 ARTEMISIA ARCTICA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	2.6(.5)	0(0)
14 ARTEMISIA BOREALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
15 ARTEMISIA GLOMERATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table B4 (cont'd).

	1309	1310	1311	1312	1313	1318	1401	1402
18 ASTRAGALUS ALPINUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
19 ASTRAGALUS UMBELLATUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
22 BRAYA PURPURASCENS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
23 BRAYA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
24 BROMUS PUMPELLIANUS ARCTICUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
25 CALTHA PALUSTRIS ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
27 CARDAMINE DIGITATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1(3)	0(0)
28 CARDAMINE PRATENSIS ANGUSTIFOLIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
29 CAREX AQUATILIS S L	0(0)	20 0(1 0)	43 0(1 0)	0(0)	4 3(1 0)	0(0)	0(0)	31 6(1 0)
30 CAREX ATROFUSCA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
31 CAREX BIGELOWII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
33 CAREX MARINA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
35 CAREX MEMBRANACEA	0(0)	0(0)	0(0)	0(0)	1(1)	0(0)	6(2)	0(0)
36 CAREX MISANDRA MISANDRA	0(0)	0(0)	0(0)	0(0)	3 5(3)	0(0)	0(0)	0(0)
37 CAREX RARIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
38 CAREX ROTUNDATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
39 CAREX RUPESTRIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	7(6)	0(0)
40 CAREX SAXATILIS LAXA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
41 CAREX SCIRPOIDEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
42 CAREX SUBSPATHACEA	0(0)	0(0)	0(0)	0(0)	0(0)	85 5(1 0)	0(0)	0(0)
44 CAREX VAGINATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
45 CAREX SP	0(0)	6(3)	0(0)	0(0)	0(0)	0(0)	1(1)	0(0)
46 CASSIOPE TETRAGONA TETRAGONA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	2(3)	0(0)
47 CERASTIUM BEERINGIANUM BEERINGIANUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
49 CHRYSANTHEMUM INTEGRIFOLIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
51 COCHLEARIA OFFICINALIS ARCTICA	2(6)	0(0)	0(0)	1.3(9)	0(0)	0(0)	0(0)	0(0)
52 DESCHAMPSIA CAESPITOSA ORIENTALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
53 DRABA ALPINA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1(1)	0(0)
56 DRABA LACTEA	0(0)	0(0)	1 0(.5)	0(0)	.1(1)	0(0)	0(0)	0(0)
57 DRABA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
58 DRYAS INTEGRIFOLIA INTEGRIFOLIA	0(0)	0(0)	0(0)	0(0)	1 5(5)	0(0)	46 8(1 0)	0(0)
59 DUPONTIA FISHERI S L	43 0(1 0)	1.6(1.0)	.1(.2)	.1(.2)	0(0)	0(0)	0(0)	0(0)
61 ELYMUS ARENARIUS MOLLIS VILLOSISSIMUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
62 EPILOBIUM LATIFOLIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
63 EQUISETUM ARVENSE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
64 EQUISETUM SCIRPOIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
65 EQUISETUM VARIEGATUM	0(0).	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
66 ERIGERON ERIOCEPHALUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
399 ERIOPHORUM ANGUSTIFOLIUM S.L.	.1(.2)	6.2(1.0)	5.9(1.0)	0(0)	.1(.3)	0(0)	.1(.1)	.2(.6)
69 ERIOPHORUM RUSSEOLUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
70 ERIOPHORUM SCHEUCHZERI SCHEUCHZERI	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	2.6(1.0)
72 ERIOPHORUM VAGINATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
73 EUTREMA EDWARDSII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
74 FESTUCA BAFFINENSIS	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)	.1(.1)	0(0)
76 FESTUCA RUBRA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
78 GENTIANELLA PROPINQUA PROPINQUA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
79 HIEROCHLOE PAUCIFLORA	0(0)	1(.1)	.1(.1)	0(0)	0(0)	0(0)	0(0)	0(0)
83 JUNCUS BIGLUMIS	0(0)	0(0)	0(0)	0(0)	.1(.3)	0(0)	0(0)	0(0)
84 JUNCUS CASTANEUS CASTANEUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
86 KOBRESIA MYOSUROIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
89 LESQUERELLA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
90 LLOYDIA SEROTINA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
91 LUZULA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)	0(0)
92 LUZULA CONFUSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
94 MINUARTIA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
96 MINUARTIA RUBELLA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
100 OXYTROPIS BOREALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
103 OXYTROPIS NIGRESCENS BRYOPHILA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
105 PAPAVER LAPPONICUM OCCIDENTALE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.3(.3)	0(0)
106 PAPAVER MACOUNII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)	0(0)
108 PARRYA NUDICAULIS NUDICAULIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
109 PEDICULARIS CAPITATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
110 PEDICULARIS LANATA	0(0)	0(0)	0(0)	0(0)	.1(.2)	0(0)	.1(.1)	0(0)
112 PEDICULARIS SUDETICA INTERIOR	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
381 PEDICULARIS SUDETICA S L	0(0)	.1(.1)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
114 PETASITES FRIGIDUS	0(0)	0(0)	.1(.3)	0(0)	0(0)	0(0)	0(0)	0(0)
117 POA ALPIGENA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
118 POA ARCTICA	0(0)	0(0)	.1(.2)	0(0)	.1(.2)	0(0)	.8(.4)	0(0)
119 POA GLAUCA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
121 POA SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
122 POLEMONIUM BOREALE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
124 POLYGONUM VIVIPARUM	0(0)	0(0)	.1(.2)	0(0)	0(0)	0(0)	.1(.2)	0(0)
127 POTENTILLA UNIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
129 PUCCINELLIA ANDERSONII	1 3(5)	0(0)	0(0)	.4(.5)	0(0)	0(0)	0(0)	0(0)
130 PUCCINELLIA PHRYGANODES	0(0)	0(0)	0(0)	6.4(.8)	0(0)	1.6(1.0)	0(0)	0(0)
131 PYROLA GRANDIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
133 RANUNCULUS PALLASII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
134 RANUNCULUS PEDATIFIDUS AFFINIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
137 SAGINA INTERMEDIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
139 SALIX ARCTICA	0(0)	0(0)	.4(.6)	0(0)	0(0)	0(0)	.1(.3)	0(0)
140 SALIX LANATA RICHARDSONII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
141 SALIX OVALIFOLIA OVALIFOLIA	.1(.1)	.1(7)	1.5(1.0)	0(0)	0(0)	0(0)	0(0)	0(0)
142 SALIX PLANIFOLIA PULCHRA PULCHRA	0(0)	0(0)	15.0(1.0)	0(0)	2.6(.1)	0(0)	0(0)	0(0)
143 SALIX RETICULATA RETICULATA	0(0)	0(0)	0(0)	0(0)	1.7(.1)	0(0)	3.3(.4)	0(0)
144 SALIX ROTUNDIFOLIA ROTUNDIFOLIA	0(0)	0(0)	0(0)	0(0)	.5(.2)	0(0)	5.2(1.0)	0(0)
145 SAUSSUREA ANGUSTIFOLIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	3.6(.3)	0(0)
146 SAXIFRAGA CAESPITOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
147 SAXIFRAGA CERNUA	0(0)	1(.1)	.1(.2)	0(0)	0(0)	0(0)	0(0)	0(0)
148 SAXIFRAGA FOLIOLOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
149 SAXIFRAGA HIERACIFOLIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
150 SAXIFRAGA HIRCULUS PROPINQUA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
151 SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	2.5(1.0)	0(0)
154 SENECIO ATROPURPUREUS FRIGIDUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.3)	0(0)
156 SENECIO RESEDIFOLIUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
157 SILENE ACAULIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.2(.3)	0(0)
159 SILENE WAHLBERGELLA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
160 STELLARIA HUMIFUSA	7(.5)	0(0)	0(0)	3.0(.7)	0(0)	2.0(.9)	0(0)	0(0)
161 STELLARIA LAETA	0(0)	.1(.1)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
164 TARAXACUM PHYMATOCARPUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
165 THALICTRUM ALPINUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
168 TRISETUM SPICATUM SPICATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
169 UTRICULARIA VULGARIS MACRORHIZA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
172 WILHELMSIA PHYSODES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
901 UNKNOWN MONOCOT	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
902 UNKNOWN DICOT	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)

Table B4 (cont'd). Raw species data for 1- × 10-m plots.
The units are percentage of cover, with frequency in parentheses.

	1309	1310	1311	1312	1313	1318	1401	1402
LIVERWORTS								
173 ANEURA PINGUIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
426 ANASTROPHYLLUM MINUTUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
175 BLEPHAROSTOMA TRICHOPHYLLUM BREVIRETE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
397 CALYPOGEIA MUELLERIANA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
460 GYMNOCOLEA INFLATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
441 HARPANTHUS FLOTOWIANUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
405 LOPHOZIA BINSTEADII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
433 LOPHOZIA HETEROCOLPA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
407 LOPHOZIA QUADRILOBA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
486 LOPHOZIA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
182 PLAGIOCHILA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
184 PTILIDIUM CILIARE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
185 RADULA PROLIFERA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
406 SCAPANIA SIMMONSII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
188 UNKNOWN LEAFY LIVERWORTS	0(0)	1(.1)	9(.3)	0(0)	0(0)	0(0)	0(0)	0(0)
189 UNKNOWN THALLOID LIVERWORTS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
MOSSES								
192 AULACOMNIUM ACUMINATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
193 AULACOMNIUM PALUSTRE	0(0)	0(0)	.1(.2)	0(0)	0(0)	0(0)	0(0)	0(0)
194 AULACOMNIUM TURGIDUM	0(0)	0(0)	.1(.3)	0(0)	0(0)	0(0)	1.0(.2)	0(0)
448 BRACHYTHECIACEAE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.3)	0(0)
432 BRACHYTHECIUM GROENLANDICUM	0(0)	0(0)	.1(.7)	0(0)	0(0)	0(0)	0(0)	0(0)
196 BRACHYTHECIUM TURGIDUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
440 BRYUM ALGOVICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
199 BRYUM ARCTICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
205 BRYUM STENOTRICHUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1(.1)	0(0)
43[illegible] BRYUM TORTIFOLIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
206 BYRUM WRIGHTII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
363 BRYUM SP	0(0)	1(.3)	2.5(.5)	0(0)	.1(.1)	0(0)	.5(5)	0(0)
209 CALLIERGON RICHARDSONII ROBUSTUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
212 CALLIERGON SP	0(0)	0(0)	.4(.3)	0(0)	0(0)	0(0)	0(0)	0(0)
213 CAMPYLIUM STELLATUM	0(0)	.2(.7)	10.2(1.0)	0(0)	0(0)	0(0)	0(0)	0(0)
214 CATOSCOPIUM NIGRITUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
215 CERATODON PURPUREUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
216 CINCLIDIUM ARCTICUM	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)	0(0)	0(0)
217 CINCLIDIUM LATIFOLIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
411 CINCLIDIUM STYGIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
449 CINCLIDIUM SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
218 CIRRIPHYLLUM CIRROSUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
219 CRATONEURON ARCTICUM	0(0)	.1(.1)	0(0)	0(0)	0(0)	0(0)	.1(.2)	0(0)
221 CTENIDIUM MOLLUSCUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
223 CYRTOMNIUM HYMENOPHYLLUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
227 DICRANUM ANGUSTUM	0(0)	0(0)	0(0)	0(0)	1.3(.7)	0(0)	0(0)	0(0)
228 DICRANUM ELONGATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
390 DICRANUM SP.	0(0)	0(0)	0(0)	0(0)	[illegible] 0)	0(0)	0(0)	0(0)
229 DIDYMODON ASPERIFOLIUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
230 DISTICHIUM CAPILLACEUM	0(0)	.1(.3)	4.5(1.0)	0(0)	0(0)	0(0)	1.7(1.0)	0(0)
232 DISTICHIUM INCLINATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.4)	0(0)
233 DITRICHUM FLEXICAULE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.6(.4)	0(0)
236 DREPANOCLADUS BREVIFOLIUS	0(0)	3.4(1.0)	.1(.1)	0(0)	0(0)	0(0)	.3(.2)	0(0)
237 DREPANOCLADUS REVOLVENS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
238 DREPANOCLADUS UNCINATUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
239 DREPANOCLADUS SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
240 ENCALYPTA ALPINA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	4(6)	0(0)
241 ENCALYPTA PROCERA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
244 ENCALYPTA SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
246 FISSIDENS OSMUNDOIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
450 FISSIDENS SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
247 FUNARIA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
250 HYLOCOMIUM SPLENDENS OBTUSIFOLIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
251 HYPNUM BAMBERGERI	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
252 HYPNUM CUPRESSIFORME	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
253 HYPNUM PROCERRIMUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
254 HYPNUM REVOLUTUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
256 HYPNUM SP.	0(0)	0(0)	1(1)	0(0)	0(0)	0(0)	3(2)	0(0)
257 LEPTOBRYUM PYRIFORME	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1(1)	0(0)
258 MEESIA TRIQUETRA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
259 MEESIA ULIGINOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
441 MNIUM ANDREWSIANUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
260 MNIUM BLYTTII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
431 PLAGIOMNIUM ELLIPTICUM	0(0)	0(0)	1(.6)	0(0)	0(0)	0(0)	0(0)	0(0)
262 MYURELLA JULACEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
264 ONCOPHORUS WAHLENBERGII	0(0)	1(.1)	1(.3)	0(0)	0(0)	0(0)	1(2)	0(0)
265 ORTHOTHECIUM CHRYSEUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
268 PHILONOTIS FONTANA PUMILA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1(1)	0(0)
410 PLAGIOPUS OEDERIANA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
272 POGONATUM ALPINUM	0(0)	0(0)	1(.2)	0(0)	1.1(.9)	0(0)	1.1(.7)	0(0)
446 POLYTRICHACEAE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
275 POHLIA NUTANS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
404 POHLIA SP.	0(0)	0(0)	1(.3)	0(0)	0(0)	0(0)	1(2)	0(0)
276 RHACOMITRIUM LANUGINOSUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
278 RHYTIDIUM RUGOSUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
279 SCORPIDIUM SCORPIOIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
280 SCORPIDIUM TURGESCENS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
282 SPLACHNUM VASCULOSUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
283 STEGONIA LATIFOLIA PILIFERA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
285 TETRAPLODON MNIOIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1(1)	0(0)
287 THUIDIUM ABIETINUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.2(4)	0(0)
288 TIMMIA AUSTRIACA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.3(2)	0(0)
289 TIMMIA MEGAPOLITANA BAVARICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
290 TIMMIA NORVEGICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
291 TOMENTHYPNUM NITENS	0(0)	0(0)	2.0(.3)	0(0)	0(0)	0(0)	3.3(1.0)	0(0)
292 TORTELLA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
296 TORTULA RURALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1(1)	0(0)
298 VOITIA HYPERBOREA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
903 UNKNOWN MOSS	1(2)	0(0)	0(0)	0(0)	.1(2)	.1(.4)	.1(7)	0(0)
LICHENS								
299 ALECTORIA NIGRICANS	0(0)	0(0)	0(0)	0(0)	1(.1)	0(0)	4(6)	0(0)
300 ALECTORIA OCHROLEUCA	0(0)	0(0)	0(0)	0(0)	.1(.2)	0(0)	0(0)	0(0)

Table B4 (cont'd).

	1309	1310	1311	1312	1313	1318	1401	1402
307 CALOPLACA SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.7)	0(0)
310 CETRARIA CUCULLATA	0(0)	0(0)	0(0)	0(0)	.1(.4)	0(0)	1.3(1.0)	0(0)
311 CETRARIA DELISEI	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
312 CETRARIA ISLANDICA	0(0)	0(0)	.1(.2)	0(0)	.1(.7)	0(0)	2.5(1.0)	0(0)
314 CETRARIA NIVALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.6(1.0)	0(0)
315 CETRARIA RICHARDSONII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)
316 CETRARIA TILESII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
385 CLADONIA GRACILIS	0(0)	0(0)	0(0)	0(0)	.1(.2)	0(0)	0(0)	0(0)
318 CLADONIA LEPIDOTA	0(0)	0(0)	0(0)	0(0)	.1(.3)	0(0)	0(0)	0(0)
427 CLADONIA PHYLLOPHORA	0(0)	.1(6)	1(.1)	0(0)	0(0)	0(0)	0(0)	0(0)
319 CLADONIA POCILLUM	0(0)	0(0)	1(.3)	0(0)	.2(.6)	0(0)	.1(.9)	0(0)
320 CLADONIA SQUAMOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
322 CLADONIA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
327 CORNICULARIA DIVERGENS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)
328 DACTYLINA ARCTICA	0(0)	0(0)	0(0)	0(0)	.1(.8)	0(0)	.2(1.0)	0(0)
329 DACTYLINA RAMULOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
330 EVERNIA PERFRAGILIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.7)	0(0)
331 FULGENSIA BRACTEATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
332 GYALECTA FOVEOLARIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
334 HYPOGYMNIA SUBOBSCURA	0(0)	0(0)	0(0)	0(0)	.1(.3)	0(0)	.2(.9)	0(0)
336 LECANORA EPIBRYON	0(0)	0(0)	0(0)	0(0)	5(.4)	0(0)	1.1(.8)	0(0)
428 LECIDEA RAMULOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
339 LECIDEA VERNALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)
393 LEPTOGIUM SINNUATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
342 LOPADIUM FECUNDUM	0(0)	0(0)	0(0)	0(0)	6 5(.4)	0(0)	2.5(1.0)	0(0)
343 OCHROLECHIA FRIGIDA	0(0)	0(0)	0(0)	0(0)	11.0(1.0)	0(0)	2.8(.8)	0(0)
413 OCHROLECHIA FRIGIDA THELEPHOROIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
348 PELTIGERA APHTHOSA	0(0)	0(0)	1(.4)	0(0)	0(0)	0(0)	.1(.1)	0(0)
349 PELTIGERA CANINA S L.	0(0)	0(0)	1(3)	0(0)	.1(.1)	0(0)	.1(.6)	0(0)
353 PELTIGERA SPURIA SOREDIATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
418 PERTUSARIA CORIACEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
358 PERTUSARIA DACTYLINA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
384 PERTUSARIA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)
360 PHYSCONIA MUSCIGENA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.3(1.0)	0(0)
412 PSOROMA HYPNORUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
400 SOLORINA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.2(.7)	0(0)
369 SPHAEROPHORUS GLOBOSUS	0(0)	0(0)	0(0)	0(0)	.2(.7)	0(0)	0(0)	0(0)
370 STEREOCAULON ALPINUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
372 THAMNOLIA SUBULIFORMIS	0(0)	1(.1)	2.0(1)	0(0)	.3(1.0)	0(0)	1.7(1.0)	0(0)
429 TONINIA CUMULATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
375 XANTHORIA ELEGANS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
403 UNKNOWN CRUSTOSE LICHEN	0(0)	.1(3)	0(0)	0(0)	0(0)	0(0)	2 2(.4)	0(0)
378 UNKNOWN FRUTICOSE LICHEN	0(0)	0(0)	0(0)	0(0)	.1(.3)	0(0)	.2(.7)	.1(.7)
379 NOSTOC COMMUNE	0(0)	1(.4)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
380 NOSTOC SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

	1403	1404	1406	1408	1411	1413	1415	1420
VASCULAR PLANTS								
2 ALOPECURUS ALPINUS ALPINUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
3 ANDROSACE CHAMAEJASME LEHMANNIANA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
4 ANDROSACE SEPTENTRIONALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
5 ANEMONE PARVIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
6 ANEMONE RICHARDSONII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
9 ARCTAGROSTIS LATIFOLIA S.L.	.1(.5)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
10 ARCTOPHILA FULVA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
12 ARMERIA MARITIMA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
13 ARTEMISIA ARCTICA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
14 ARTEMISIA BOREALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
15 ARTEMISIA GLOMERATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
18 ASTRAGALUS ALPINUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
19 ASTRAGULUS UMBELLATUS	0(0)	0(0)	0(0)	0(0)	1.1(.6)	0(0)	0(0)	0(0)
22 BRAYA PURPURASCENS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
23 BRAYA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
24 BROMUS PUMPELLIANUS ARCTICUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
25 CALTHA PALUSTRIS ARCTICA	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)	0(0)
27 CARDAMINE DIGITATA	.1(.2)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
28 CARDAMINE PRATENSIS ANGUSTIFOLIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
29 CAREX AQUATILIS S.L.	0(0)	26 8(1.0)	37 7(1.0)	22 4(1.0)	0(0)	39.9(1.0)	12.1(1.0)	6.6(1.0)
30 CAREX ATROFUSCA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.3(.2)
31 CAREX BIGELOWII	14.3(.9)	0(0)	0(0)	0(0)	0(0)	0(0)	.4(.3)	0(0)
33 CAREX MARINA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
35 CAREX MEMBRANACEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
36 CAREX MISANDRA MISANDRA	0(0)	0(0)	.2(.1)	0(0)	0(0)	0(0)	2.2(.8)	1.0(.9)
37 CAREX RARIFLORA	0(0)	2.9(.7)	0(0)	0(0)	0(0)	0(0)	0(0)	11.2(1.0)
38 CAREX ROTUNDATA	0(0)	0(0)	0(0)	0(0)	0(0)	3.9(.9)	0(0)	3.3(1.0)
39 CAREX RUPESTRIS	0(0)	0(0)	0(0)	0(0)	1.6(.7)	0(0)	0(0)	0(0)
40 CAREX SAXATILIS LAXA	0(0)	0(0)	0(0)	0(0)	0(0)	.5(.3)	0(0)	0(0)
41 CAREX SCIRPOIDEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
42 CAREX SUBSPATHACEA	0(0)	1.6(.8)	0(0)	0(0)	0(0)	0(0)	0(0)	2.1(.9)
44 CAREX VAGINATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
45 CAREX SP	.1(.1)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)
46 CASSIOPE TETRAGONA TETRAGONA	1.5(.7)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
47 CERASTIUM BEERINGIANUM BEERINGIANUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
49 CHRYSANTHEMUM INTEGRIFOLIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)
51 COCHLEARIA OFFICINALIS ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
52 DESCHAMPSIA CAESPITOSA ORIENTALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
53 DRABA ALPINA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.4(9)	0(0)
56 DRABA LACTEA	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)	0(0)	.1(.1)
57 DRABA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
58 DRYAS INTEGRIFOLIA INTEGRIFOLIA	10 4(1.0)	0(0)	17.9(1.0)	0(0)	31.5(1 0)	0(0)	16 3(1.0)	.1(.3)
59 DUPONTIA FISHERI S.L	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
61 ELYMUS ARENARIUS MOLLIS VILLOSISSIMUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
62 EPILOBIUM LATIFOLIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
63 EQUISETUM ARVENSE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
64 EQUISETUM SCIRPOIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
65 EQUISETUM VARIEGATUM	0(0)	1(1)	.1(.3)	0(0)	0(0)	0(0)	1(.9)	.1(.3)
66 ERIGERON ERIOCEPHALUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
399 ERIOPHORUM ANGUSTIFOLIUM S.L.	14.0(.9)	7 8(1.0)	9.1(1 0)	.7(.6)	0(0)	1.1(.8)	.5(4)	1.8(1.0)
69 ERIOPHORUM RUSSEOLUM	0(0)	.9(1.0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.9)
70 ERIOPHORUM SCHEUCHZERI SCHEUCHZERI	0(0)	0(0)	0(0)	2 5(1 0)	0(0)	.5(.9)	0(0)	0(0)
72 ERIOPHORUM VAGINATUM	3 3(3)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
73 EUTREMA EDWARDSII	0(0)	0(0)	1(.1)	0(0)	0(0)	0(0)	.1(.6)	0(0)

Table B4 (cont'd). Raw species data for 1- × 10-m plots.
The units are percentage of cover, with frequency in parentheses.

	1403	1404	1406	1408	1411	1413	1415	1420
74 FESTUCA BAFFINENSIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
76 FESTUCA RUBRA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
78 GENTIANELLA PROPINQUA PROPINQUA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
79 HIEROCHLOE PAUCIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
83 JUNCUS BIGLUMIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.7)	.1(.2)
84 JUNCUS CASTANEUS CASTANEUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
86 KOBRESIA MYOSUROIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
89 LESQUERELLA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
90 LLOYDIA SEROTINA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
91 LUZULA ARCTICA	.1(.4)	0(0)	.1(3)	0(0)	0(0)	0(0)	.1(.4)	0(0)
92 LUZULA CONFUSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
94 MINUARTIA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
96 MINUARTIA RUBELLA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)
100 OXYTROPIS BOREALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
103 OXYTROPIS NIGRESCENS BRYOPHILA	0(0)	0(0)	0(0)	0(0)	3.2(1 0)	0(0)	0(0)	0(0)
105 PAPAVER LAPPONICUM OCCIDENTALE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
106 PAPAVER MACOUNII	.1(.3)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
108 PARRYA NUDICAULIS NUDICAULIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
109 PEDICULARIS CAPITATA	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)
110 PEDICULARIS LANATA	0(0)	0(0)	1(2)	0(0)	0(0)	0(0)	.1(.2)	0(0)
112 PEDICULARIS SUDETICA INTERIOR	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
381 PEDICULARIS SUDETICA S L	0(0)	.2(.7)	0(0)	0(0)	0(0)	0(0)	0(0)	.3(.9)
114 PETASITES FRIGIDUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
117 POA ALPIGENA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
118 POA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
119 POA GLAUCA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
121 POA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
122 POLEMONIUM BOREALE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
124 POLYGONUM VIVIPARUM	.1(2)	1(7)	.1(2)	0(0)	1(.5)	0(0)	0(0)	.2(.6)
127 POTENTILLA UNIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
129 PUCCINELLIA ANDERSONII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
130 PUCCINELLIA PHRYGANODES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
131 PYROLA GRANDIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
133 RANUNCULUS PALLASII	0(0)	0(0)	0(0)	.6(1.0)	0(0)	0(0)	0(0)	0(0)
134 RANUNCULUS PEDATIFIDUS AFFINIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
137 SAGINA INTERMEDIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
139 SALIX ARCTICA	0(0)	1(.5)	.1(2)	0(0)	0(0)	0(0)	1.3(.8)	.1(.2)
140 SALIX LANATA RICHARDSONII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
141 SALIX OVALIFOLIA OVALIFOLIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.7)
142 SALIX PLANIFOLIA PULCHRA PULCHRA	0(0)	.5(.2)	1(.2)	0(0)	0(0)	0(0)	0(0)	0(0)
143 SALIX RETICULATA RETICULATA	8 7(1 0)	.1(.5)	2 1(.9)	0(0)	2.2(9)	0(0)	3.5(.9)	.1(.2)
144 SALIX ROTUNDIFOLIA ROTUNDIFOLIA	1.0(.5)	0(0)	0(0)	0(0)	.1(.1)	0(0)	.1(.1)	0(0)
145 SAUSSUREA ANGUSTIFOLIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
146 SAXIFRAGA CAESPITOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
147 SAXIFRAGA CERNUA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
148 SAXIFRAGA FOLIOLOSA	0(0)	.5(.6)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.4)
149 SAXIFRAGA HIERACIFOLIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
150 SAXIFRAGA HIRCULUS PROPINQUA	0(0)	.4(.5)	1(.2)	0(0)	0(0)	0(0)	0(0)	.1(.4)
151 SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	0(0)	0(0)	0(0)	0(0)	1.1(.9)	0(0)	.1(.5)	0(0)
154 SENECIO ATROPURPUREUS FRIGIDUS	1(.7)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)
156 SENECIO RESEDIFOLIUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
157 SILENE ACAULIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
159 SILENE WAHLBERGELLA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.4(.4)	.1(.4)
160 STELLARIA HUMIFUSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
161 STELLARIA LAETA	1(.5)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)	0(0)
164 TARAXACUM PHYMATOCARPUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
165 THALICTRUM ALPINUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
168 TRISETUM SPICATUM SPICATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
169 UTRICULARIA VULGARIS MACRORHIZA	0(0)	0(0)	0(0)	.1(1)	0(0)	0(0)	0(0)	0(0)
172 WILHELMSIA PHYSODES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
901 UNKNOWN MONOCOT	.1(.1)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
902 UNKNOWN DICOT	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.5)	0(0)
LIVERWORTS								
173 ANEURA PINGUIS	0(0)	0(0)	.1(1)	0(0)	0(0)	0(0)	0(0)	0(0)
426 ANASTROPHYLLUM MINUTUM	.1(.3)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
175 BLEPHAROSTOMA TRICHOPHYLLUM BREVIRETE	.1(1.0)	0(0)	.1(.4)	0(0)	0(0)	0(0)	0(0)	0(0)
397 CALYPOGEIA MUELLERIANA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
460 GYMNOCOLEA INFLATA	.1(.4)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
441 HARPANTHUS FLOTOWIANUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
405 LOPHOZIA BINSTEADII	1(1.0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
433 LOPHOZIA HETEROCOLPA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
407 LOPHOZIA QUADRILOBA	.1(6)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
486 LOPHOZIA SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
182 PLAGIOCHILA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
184 PTILIDIUM CILIARE	12 5(8)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
185 RADULA PROLIFERA	.1(.2)	0(0)	.1(.3)	0(0)	0(0)	0(0)	0(0)	0(0)
406 SCAPANIA SIMMONSII	2 0(1.0)	0(0)	3 5(5)	0(0)	0(0)	0(0)	0(0)	0(0)
188 UNKNOWN LEAFY LIVERWORTS	0(0)	.2(.7)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)
189 UNKNOWN THALLOID LIVERWORTS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
MOSSES								
192 AULACOMNIUM ACUMINATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
193 AULACOMNIUM PALUSTRE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
194 AULACOMNIUM TURGIDUM	1(9)	0(0)	.1(4)	0(0)	0(0)	0(0)	0(0)	.1(.2)
448 BRACHYTHECIACEAE	1(1)	0(0)	1(.5)	0(0)	.1(2)	0(0)	0(0)	0(0)
432 BRACHYTHECIUM GROENLANDICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
196 BRACHYTHECIUM TURGIDUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
440 BRYUM ALGOVICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
199 BRYUM ARCTICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
205 BRYUM STENOTRICHUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
439 BRYUM TORTIFOLIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
206 BRYUM WRIGHTII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
383 BRYUM SP	.1(.1)	0(0)	1(1)	0(0)	0(0)	0(0)	.3(.9)	0(0)
209 CALLIERGON RICHARDSONII ROBUSTUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
212 CALLIERGON SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.2(.4)
213 CAMPYLIUM STELLATUM	0(0)	0(0)	1(7)	0(0)	0(0)	0(0)	1(2)	.1(.1)
214 CATOSCOPIUM NIGRITUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
215 CERATODON PURPUREUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
216 CINCLIDIUM ARCTICUM	0(0)	.7(.5)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
217 CINCLIDIUM LATIFOLIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
411 CINCLIDIUM STYGIUM	1(4)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)

Table B4 (cont'd).

	1403	1404	1406	1408	1411	1413	1415	1420
449 CINCLIDIUM SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
218 CIRRIPHYLLUM CIRROSUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
219 CRATONEURON ARCTICUM	.1(.3)	0(0)	.1(.5)	0(0)	0(0)	0(0)	0(0)	0(0)
221 CTENIDIUM MOLLUSCUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
223 CYRTOMNIUM HYMENOPHYLLUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
227 DICRANUM ANGUSTUM	3.6(.4)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
228 DICRANUM ELONGATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	4(3)	0(0)
390 DICRANUM SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
229 DIDYMODON ASPERIFOLIUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
230 DISTICHIUM CAPILLACEUM	3.0(4)	0(0)	5 7(.9)	0(0)	1.8(1.0)	0(0)	1 1(1 0)	.1(.2)
232 DISTICHIUM INCLINATUM	.5(.3)	0(0)	1(.4)	0(0)	0(0)	0(0)	5(3)	0(0)
233 DITRICHUM FLEXICAULE	2.5(.4)	0(0)	8.5(.8)	0(0)	.2(.1)	0(0)	1.0(2)	0(0)
236 DREPANOCLADUS BREVIFOLIUS	0(0)	28 0(1.0)	.9(.5)	0(0)	0(0)	0(0)	0(0)	15.0(1.0)
237 DREPANOCLADUS REVOLVENS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
238 DREPANOCLADUS UNCINATUS	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)
239 DREPANOCLADUS SP.	.1(.1)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
240 ENCALYPTA ALPINA	.1(.1)	0(0)	0(0)	0(0)	.1(.1)	0(0)	1 7(.7)	0(0)
241 ENCALYPTA PROCERA	.1(.2)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
244 ENCALYPTA SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
246 FISSIDENS OSMUNDOIDES	1(.3)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
450 FISSIDENS SP.	0(0)	0(0)	.1(6)	0(0)	0(0)	0(0)	0(0)	.1(.1)
247 FUNARIA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
250 HYLOCOMIUM SPLENDENS OBTUSIFOLIUM	11 4(.9)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
251 HYPNUM BAMBERGERI	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
252 HYPNUM CUPRESSIFORME	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
253 HYPNUM PROCERRIMUM	.2(.1)	0(0)	0(0)	0(0)	.1(1)	0(0)	0(0)	0(0)
254 HYPNUM REVOLUTUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
256 HYPNUM SP.	.1(.1)	0(0)	.1(2)	0(0)	0(0)	0(0)	0(0)	0(0)
257 LEPTOBRYUM PYRIFORME	0(0)	0(0)	0(0)	C(0)	0(0)	0(0)	0(0)	0(0)
258 MEESIA TRIQUETRA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
259 MEESIA ULIGINOSA	0(0)	0(0)	.1(.5)	0(0)	0(0)	0(0)	0(0)	0(0)
444 MNIUM ANDREWSIANUM	.1(.1)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
260 MNIUM BLYTTII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
431 PLAGIOMNIUM ELLIPTICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
262 MYURELLA JULACEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
264 ONCOPHORUS WAHLENBERGII	7(3)	1(.4)	3.3(4)	0(0)	0(0)	0(0)	.7(2)	0(0)
265 ORTHOTHECIUM CHRYSEUM	0(0)	4(6)	1.8(8)	0(0)	0(0)	0(0)	.1(2)	0(0)
268 PHILONOTIS FONTANA PUMILA	5.0(.1)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
410 PLAGIOPUS OEDERIANA	.1(.1)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
272 POGONATUM ALPINUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)
446 POLYTRICHACEAE	.1(.1)	1(.4)	.1(.6)	0(0)	0(0)	0(0)	0(0)	0(0)
275 POHLIA NUTANS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
404 POHLIA SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
276 RHACOMITRIUM LANUGINOSUM	.2(.1)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
278 RHYTIDIUM RUGOSUM	1(.1)	.2(.3)	.2(.3)	0(0)	.1(.4)	0(0)	5(6)	0(0)
279 SCORPIDIUM SCORPIOIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	3 0(.9)
280 SCORPIDIUM TURGESCENS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
282 SPLACHNUM VASCULOSUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
283 STEGONIA LATIFOLIA PILIFERA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
285 TETRAPLODON MNIOIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
287 THUIDIUM ABIETINUM	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)
288 TIMMIA AUSTRIACA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)	0(0)
289 TIMMIA MEGAPOLITANA BAVARICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
290 TIMMIA NORVEGICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
291 TOMENTHYPNUM NITENS	21.6(1.0)	0(0)	25.7(1.0)	0(0)	0(0)	0(0)	2 0(.6)	0(0)
292 TORTELLA ARCTICA	0(0)	0(0)	10 0(.6)	0(0)	0(0)	0(0)	0(0)	0(0)
296 TORTULA RURALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
298 VOITIA HYPERBOREA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
903 UNKNOWN MOSS	3(.9)	0(0)	2.0(.3)	0(0)	.1(.7)	0(0)	1 6(9)	.1(4)
LICHENS								
299 ALECTORIA NIGRICANS	.1(.7)	0(0)	0(0)	0(0)	.1(6)	0(0)	1.1(9)	0(0)
300 ALECTORIA OCHROLEUCA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
307 CALOPLACA SP.	.1(.1)	0(0)	.1(.4)	0(0)	.1(1.0)	0(0)	.1(7)	0(0)
310 CETRARIA CUCULLATA	1.0(.7)	0(0)	.8(.6)	0(0)	.1(1.0)	0(0)	1.7(1 0)	0(0)
311 CETRARIA DELISEI	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
312 CETRARIA ISLANDICA	1.0(.9)	0(0)	1.9(.7)	0(0)	.1(1.0)	0(0)	.4(9)	0(0)
314 CETRARIA NIVALIS	.2(.5)	0(0)	.1(.2)	0(0)	.7(1.0)	0(0)	.4(1 0)	0(0)
315 CETRARIA RICHARDSONII	1(.2)	0(0)	.1(.1)	0(0)	0(0)	0(0)	0(0)	0(0)
316 CETRARIA TILESII	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)
385 CLADONIA GRACILIS	.1(1)	1(.3)	.1(.1)	0(0)	0(0)	0(0)	1(7)	0(0)
318 CLADONIA LEPIDOTA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
127 CLADONIA PHYLLOPHORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
319 CLADONIA POCILLUM	.1(.7)	0(0)	0(0)	0(0)	0(0)	0(0)	1(8)	0(0)
320 CLADONIA SQUAMOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)
322 CLADONIA SP.	.1(.2)	0(0)	.7(6)	0(0)	0(0)	0(0)	1(2)	0(0)
327 CORNICULARIA DIVERGENS	0(0)	0(0)	0(0)	0(0)	1(1.0)	0(0)	1(1)	0(0)
328 DACTYLINA ARCTICA	7(.9)	0(0)	1 5(9)	0(0)	1(4)	0(0)	7(1 0)	1(2)
329 DACTYLINA RAMULOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
330 EVERNIA PERFRAGILIS	0(0)	0(0)	0(0)	0(0)	1(9)	0(0)	2(5)	0(0)
331 FULGENSIA BRACTEATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
332 GYALECTA FOVEOLARIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
334 HYPOGYMNIA SUBOBSCURA	0(0)	0(0)	0(0)	0(0)	1(9)	0(0)	2(6)	0(0)
336 LECANORA EPIBRYON	0(0)	0(0)	3(3)	0(0)	1 9(.9)	0(0)	6(8)	.1(.2)
428 LECIDEA RAMULOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1(3)	0(0)
339 LECIDEA VERNALIS	0(0)	0(0)	0(0)	0(0)	1(5)	0(0)	0(0)	0(0)
393 LEPTOGIUM SINNUATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
342 LOPADIUM FECUNDUM	.1(.1)	0(0)	0(0)	0(0)	1 4(9)	0(0)	2 5(9)	0(0)
343 OCHROLECHIA FRIGIDA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
413 OCHROLECHIA FRIGIDA THELEPHOROIDES	1(3)	1(8)	7(.6)	0(0)	1(8)	0(0)	21 8(9)	0(0)
348 PELTIGERA APHTHOSA	1(.1)	0(0)	5(1)	0(0)	0(0)	0(0)	0(0)	0(0)
349 PELTIGERA CANINA S.L.	1(.3)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
353 PELTIGERA SPURIA SOREDIATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
418 PERTUSARIA CORIACEA	0(0)	0(0)	0(0)	0(0)	1 0(9)	0(0)	0(0)	0(0)
358 PERTUSARIA DACTYLINA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
384 PERTUSARIA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
360 PHYSCONIA MUSCIGENA	0(0)	0(0)	0(0)	0(0)	1(8)	0(0)	1(1)	0(0)
412 PSOROMA HYPNORUM	1(1)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
400 SOLORINA SP	1(1)	0(0)	1(1)	0(0)	2(7)	0(0)	1(5)	.1(1)
369 SPHAEROPHORUS GLOBOSUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
370 STEREOCAULON ALPINUM	1(1)	0(0)	1(.1)	0(0)	1(.2)	0(0)	0(0)	0(0)
372 THAMNOLIA SUBULIFORMIS	1 1(9)	0(0)	2 2(1 0)	0(0)	9(1.0)	0(0)	2 6(1 0)	1(2)
429 TONINIA CUMULATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
375 XANTHORIA ELEGANS	0(0)	0(0)	0(0)	0(0)	.1(1 0)	0(0)	0(0)	0(0)
403 UNKNOWN CRUSTOSE LICHEN	0(0)	0(0)	1(1)	0(0)	1 6(5)	0(0)	5(4)	0(0)

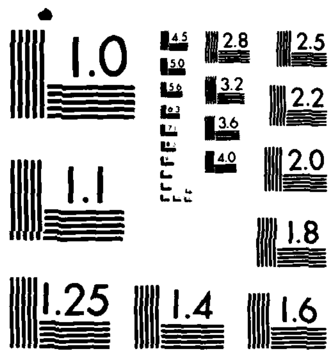
Table B4 (cont'd). Raw species data for 1- × 10-m plots.
The units are percentage of cover, with frequency in parentheses.

	1403	1404	1406	1408	1411	1413	1415	1420
370 UNKNOWN FRUTICOSE LICHEN	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
379 NOSTOC COMMUNE	0(0)	1.7(.9)	0(0)	0(0)	0(0)	23.0(1.0)	0(0)	4.6(1.0)
380 NOSTOC SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

	1501	1503	1504	1505	1507	1508	1510	1511
VASCULAR PLANTS								
2 ALOPECURUS ALPINUS ALPINUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
3 ANDROSACE CHAMAEJASME LEHMANNIANA	0(0)	0(0)	0(0)	0(0)	.1(.3)	0(0)	0(0)	0(0)
4 ANDROSACE SEPTENTRIONALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
5 ANEMONE PARVIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
6 ANEMONE RICHARDSONII	0(0)	0(0)	0(0)	0(0)	.2(1.0)	0(0)	0(0)	0(0)
9 ARCTAGROSTIS LATIFOLIA S.L.	0(0)	0(0)	1(2)	0(0)	0(0)	0(0)	1(3)	0(0)
10 ARCTOPHILA FULVA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
12 ARMERIA MARITIMA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
13 ARTEMISIA ARCTICA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
14 ARTEMISIA BOREALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
15 ARTEMISIA GLOMERATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
18 ASTRAGALUS ALPINUS	0(0)	0(0)	0(0)	0(0)	3.5(1.0)	0(0)	0(0)	0(0)
19 ASTRAGALUS UMBELLATUS	0(0)	0(0)	0(0)	6(3)	1.4(1.0)	0(0)	0(0)	0(0)
22 BRAYA PURPURASCENS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
23 BRAYA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
24 BROMUS PUMPELLIANUS ARCTICUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
25 CALTHA PALUSTRIS ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
27 CARDAMINE DIGITATA	0(0)	0(0)	.1(8)	0(0)	0(0)	0(0)	1(3)	0(0)
28 CARDAMINE PRATENSIS ANGUSTIFOLIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
29 CAREX AQUATILIS S.L.	22.1(1.0)	13.3(1.0)	0(0)	0(0)	0(0)	26.2(1.0)	2(3)	10.8(1.0)
30 CAREX ATROFUSCA	0(0)	2.1(9)	0(0)	0(0)	0(0)	0(0)	0(0)	1(3)
31 CAREX BIGELOWII	0(0)	0(0)	5.6(9)	0(0)	0(0)	0(0)	1.0(6)	0(0)
33 CAREX MARINA	.1(4)	1.6(7)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
35 CAREX MEMBRANACEA	0(0)	1.8(5)	4.8(1.0)	0(0)	0(0)	1(3)	11.4(9)	1.2(5)
36 CAREX MISANDRA MISANDRA	0(0)	.1(1)	0(0)	0(0)	0(0)	0(0)	0(0)	1(2)
37 CAREX RARIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
38 CAREX ROTUNDATA	.1(.4)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	2.8(9)
39 CAREX RUPESTRIS	0(0)	0(0)	0(0)	5.9(1.0)	1.5(2)	0(0)	0(0)	0(0)
40 CAREX SAXATILIS LAXA	1.3(.9)	1.0(.5)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
41 CAREX SCIRPOIDEA	0(0)	0(0)	3(.1)	1(1)	4.6(1.0)	0(0)	0(0)	0(0)
42 CAREX SUBSPATHACEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
44 CAREX VAGINATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
45 CAREX SP	0(0)	1(.1)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
46 *CASSIOPE TETRAGONA TETRAGONA*	0(0)	0(0)	1(6)	0(0)	0(0)	0(0)	0(0)	0(0)
47 CERASTIUM BEERINGIANUM BEERINGIANUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
49 CHRYSANTHEMUM INTEGRIFOLIUM	0(0)	0(0)	2(9)	2(8)	6(1.0)	0(0)	1(1)	0(0)
51 COCHLEARIA OFFICINALIS ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
52 DESCHAMPSIA CAESPITOSA ORIENTALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
53 DRABA ALPINA	0(0)	0(0)	1(7)	1(3)	1(3)	0(0)	1(2)	0(0)
56 DRABA LACTEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
57 DRABA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
58 DRYAS INTEGRIFOLIA INTEGRIFOLIA	0(0)	2(.3)	50.5(1.0)	58.7(1.0)	42.1(1.0)	1(1)	28.3(1.0)	1(1)
59 DUPONTIA FISHERI S.L.	1(7)	2(2)	0(0)	0(0)	0(0)	2.1(1.0)	1(3)	1(4)
61 *ELYMUS ARENARIUS MOLLIS VILLOSISSIMUS*	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
62 EPILOBIUM LATIFOLIUM	0(0)	0(0)	0(0)	0(0)	0(0)	1(1)	0(0)	0(0)
63 EQUISETUM ARVENSE	0(0)	0(0)	0(0)	0(0)	0(0)	3(6)	0(0)	0(0)
64 EQUISETUM SCIRPOIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
65 EQUISETUM VARIEGATUM	2(.9)	7(1.0)	1(6)	0(0)	2(1)	1(5)	0(0)	1(8)
66 ERIGERON ERIOCEPHALUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
399 ERIOPHORUM ANGUSTIFOLIUM S.L.	1.2(.8)	4.4(9)	13.7(1.0)	0(0)	0(0)	3.0(9)	18.3(1.0)	21.5(1.0)
69 ERIOPHORUM RUSSEOLUM	.1(.9)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1(4)
70 ERIOPHORUM SCHEUCHZERI SCHEUCHZERI	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
72 ERIOPHORUM VAGINATUM	0(0)	0(0)	2(.1)	0(0)	0(0)	0(0)	0(0)	0(0)
73 EUTREMA EDWARDSII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
74 FESTUCA BAFFINENSIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
76 FESTUCA RUBRA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
78 *GENTIANELLA PROPINQUA PROPINQUA*	0(0)	0(0)	0(0)	0(0)	2(5)	1(6)	0(0)	0(0)
79 HIEROCHLOE PAUCIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
83 JUNCUS BIGLUMIS	0(0)	.1(3)	1(1)	0(0)	0(0)	0(0)	0(0)	1([illegible])
84 JUNCUS CASTANEUS CASTANEUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
86 KOBRESIA MYOSUROIDES	0(0)	0(0)	0(0)	1(3)	1.0(9)	0(0)	0(0)	0(0)
89 LESQUERELLA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
90 LLOYDIA SEROTINA	0(0)	0(0)	0(0)	2(1.0)	1(8)	0(0)	0(0)	0(0)
91 LUZULA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
92 LUZULA CONFUSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
94 MINUARTIA ARCTICA	0(0)	0(0)	6(1.0)	9(4)	1(4)	0(0)	0(0)	0(0)
96 MINUARTIA RUBELLA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
100 OXYTROPIS BOREALIS	0(0)	0(0)	0(0)	0(0)	1.3(6)	0(0)	0(0)	0(0)
103 OXYTROPIS NIGRESCENS BRYOPHILA	0(0)	0(0)	0(0)	0(0)	2(1)	0(0)	0(0)	0(0)
105 *PAPAVER LAPPONICUM OCCIDENTALE*	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
106 PAPAVER MACOUNII	0(0)	0(0)	5(1.0)	1(2)	2(7)	0(0)	0(0)	0(0)
108 PARRYA NUDICAULIS NUDICAULIS	0(0)	0(0)	0(0)	1(2)	2(7)	0(0)	0(0)	0(0)
109 PEDICULARIS CAPITATA	0(0)	0(0)	0(0)	.1(1)	2(5)	0(0)	1(3)	0(0)
110 PEDICULARIS LANATA	0(0)	0(0)	2(8)	1(3)	2(8)	0(0)	5(7)	0(0)
112 PEDICULARIS SUDETICA INTERIOR	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
381 PEDICULARIS SUDETICA S.L.	5(8)	1.2(1.0)	0(0)	0(0)	0(0)	0(0)	0(0)	6(9)
111 PETASITES FRIGIDUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
117 POA ALPIGENA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
118 POA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
119 POA GLAUCA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
121 POA SP	0(0)	0(0)	0(0)	1(1)	1(3)	0(0)	0(0)	0(0)
122 POLEMONIUM BOREALE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
124 POLYGONUM VIVIPARUM	2(3)	2(8)	1(5)	1(5)	6(1.0)	2(7)	0(0)	1(1)
127 POTENTILLA UNIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
129 PUCCINELLIA ANDERSONII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
130 PUCCINELLIA PHRYGANODES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
131 PYROLA GRANDIFLORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
133 RANUNCULUS PALLASII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
134 RANUNCULUS PEDATIFIDUS AFFINIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
137 SAGINA INTERMEDIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
139 SALIX ARCTICA	3(3)	6(8)	1.4(1.0)	0(0)	0(0)	0(0)	2.6(9)	5(6)
140 SALIX LANATA RICHARDSONII	0(0)	3(2)	0(0)	0(0)	1(2)	0(0)	0(0)	0(0)
141 SALIX OVALIFOLIA OVALIFOLIA	2(1)	1(3)	0(0)	0(0)	0(0)	6.4(1.0)	0(0)	0(0)
142 SALIX PLANIFOLIA PULCHRA PULCHRA	0(0)	0(0)	3(7)	0(0)	0(0)	0(0)	0(0)	0(0)

AD-A162 022 VEGETATION AND ENVIRONMENTAL GRADIENTS OF THE PRUDHOE BAY REGION ALASKA(U) COLD REGIONS RESEARCH AND ENGINEERING LAB HANOVER NH D A WALKER SEP 85 3/3

UUCLASSIFIED CRREL-85-14 F/G 6/3 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Table B4 (cont'd).

	1501	1503	1504	1505	1507	1508	1510	1511
143 SALIX RETICULATA RETICULATA	.1(.1)	0(0)	.1(.4)	0(0)	3.3(1.0)	11.4(1.0)	.1(.3)	.1(.1)
144 SALIX ROTUNDIFOLIA ROTUNDIFOLIA	0(0)	0(0)	.1(.2)	.1(.1)	5.4(1.0)	8.2(1.0)	0(0)	0(0)
145 SAUSSUREA ANGUSTIFOLIA	0(0)	0(0)	0(0)	1.2(.9)	.1(.2)	0(0)	0(0)	0(0)
146 SAXIFRAGA CAESPITOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
147 SAXIFRAGA CERNUA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
148 SAXIFRAGA FOLIOLOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
149 SAXIFRAGA HIERACIFOLIA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
150 SAXIFRAGA HIRCULUS PROPINQUA	0(0)	.1(.5)	0(0)	0(0)	0(0)	.1(.2)	0(0)	0(0)
151 SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	.1(.1)	.1(.2)	1.6(.8)	9.8(1.0)	2.9(1.0)	0(0)	.8(.8)	0(0)
154 SENECIO ATROPURPUREUS FRIGIDUS	0(0)	0(0)	.4(1.0)	0(0)	0(0)	0(0)	.2(.9)	0(0)
156 SENECIO RESEDIFOLIUS	0(0)	0(0)	0(0)	0(0)	.1(.5)	0(0)	0(0)	0(0)
157 SILENE ACAULIS	0(0)	0(0)	0(0)	0(0)	.3(1.0)	0(0)	0(0)	0(0)
159 SILENE WAHLBERGELLA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
160 STELLARIA HUMIFUSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
161 STELLARIA LAETA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
164 TARAXACUM PHYMATOCARPUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
165 THALICTRUM ALPINUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
168 TRISETUM SPICATUM SPICATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
169 UTRICULARIA VULGARIS MACRORHIZA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
172 WILHELMSIA PHYSODES	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.6)	0(0)	0(0)
901 UNKNOWN MONOCOT	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)	0(0)
902 UNKNOWN DICOT	0(0)	0(0)	.1(.1)	.1(.1)	.1(.2)	.1(.2)	0(0)	.1(.2)
LIVERWORTS								
173 ANEURA PINGUIS	0(0)	.1(.1)	0(0)	0(0)	.1(.4)	0(0)	.1(.1)	.1(.2)
426 ANASTROPHYLLUM MINUTUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
175 BLEPHAROSTOMA TRICHOPHYLLUM BREVIRETE	0(0)	0(0)	.1(.1)	.1(.7)	0(0)	0(0)	0(0)	0(0)
397 CALYPOGEIA MUELLERIANA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
460 GYMNOCOLEA INFLATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
441 HARPANTHUS FLOTOWIANUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
405 LOPHOZIA BINSTEADII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
433 LOPHOZIA HETEROCOLPA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
407 LOPHOZIA QUADRILOBA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
486 LOPHOZIA SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
182 PLAGIOCHILA ARCTICA	0(0)	0(0)	.1(.3)	0(0)	0(0)	0(0)	0(0)	0(0)
184 PTILIDIUM CILIARE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
185 RADULA PROLIFERA	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)	0(0)	0(0)
406 SCAPANIA SIMMONSII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
188 UNKNOWN LEAFY LIVERWORTS	.1(.3)	0(0)	.1(.2)	0(0)	0(0)	0(0)	0(0)	0(0)
189 UNKNOWN THALLOID LIVERWORTS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
MOSSES								
192 AULACOMNIUM ACUMINATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
193 AULACOMNIUM PALUSTRE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
194 AULACOMNIUM TURGIDUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
448 BRACHYTHECIACEAE	.1(.1)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
432 BRACHYTHECIUM GROENLANDICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)	0(0)
196 BRACHYTHECIUM TURGIDUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
440 BRYUM ALGOVICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
199 BRYUM ARCTICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
205 BRYUM STENOTRICHUM	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)	0(0)	0(0)
429 BRYUM TORTIFOLIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
206 BYRUM WRIGHTII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
383 BRYUM SP.	1.5(.3)	2.0(.6)	.3(.2)	.1(.2)	.1(.1)	1.6(1.0)	.1(.6)	.1(.4)
209 CALLIERGON RICHARDSONII ROBUSTUM	4.7(1.0)	4.8(1.0)	0(0)	0(0)	0(0)	1.3(1.0)	0(0)	0(0)
212 CALLIERGON SP	0(0)	0(0)	0(0)	0(0)	0(0)	6.1(.9)	.1(.6)	.4(.4)
213 CAMPYLIUM STELLATUM	.1(.2)	3.2(.3)	2.0(.5)	0(0)	.2(.3)	16.5(1.0)	.4(.8)	.1(.1)
214 CATOSCOPIUM NIGRITUM	.1(.1)	2.1(.5)	1.0(.1)	0(0)	0(0)	.1(.7)	.1(.2)	.1(.1)
215 CERATODON PURPUREUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
216 CINCLIDIUM ARCTICUM	.1(.4)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.3)	0(0)
217 CINCLIDIUM LATIFOLIUM	10.8(1.0)	12.7(.9)	0(0)	0(0)	0(0)	0(0)	0(0)	1.2(.6)
411 CINCLIDIUM STYGIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
449 CINCLIDIUM SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
218 CIRRIPHYLLUM CIRROSUM	0(0)	0(0)	.5(.4)	0(0)	0(0)	0(0)	0(0)	0(0)
219 CRATONEURON ARCTICUM	0(0)	0(0)	.1(.6)	.1(.2)	0(0)	0(0)	.1(.8)	0(0)
221 CTENIDIUM MOLLUSCUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
223 CYRTOMNIUM HYMENOPHYLLUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
227 DICRANUM ANGUSTUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
228 DICRANUM ELONGATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
390 DICRANUM SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
229 DIDYMODON ASPERIFOLIUS	0(0)	0(0)	0(0)	.1(.1)	.5(.3)	0(0)	.1(.1)	0(0)
230 DISTICHIUM CAPILLACEUM	2.0(3)	5.0(.7)	5.5(1.0)	.3(.8)	6.9(.8)	0(0)	2.9(1.0)	.5(.4)
232 DISTICHIUM INCLINATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
233 DITRICHUM FLEXICAULE	0(0)	.1(.1)	33.5(1.0)	1.3(.9)	16.0(.6)	0(0)	22.0(.9)	0(0)
236 DREPANOCLADUS BREVIFOLIUS	49.5(1.0)	30.0(1.0)	2 5(.7)	0(0)	0(0)	.5(.8)	3.9(1.0)	5.9(.9)
237 DREPANOCLADUS REVOLVENS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
238 DREPANOCLADUS UNCINATUS	0(0)	0(0)	0(0)	.1(.1)	5.1(.5)	0(0)	0(0)	0(0)
239 DREPANOCLADUS SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
240 ENCALYPTA ALPINA	.1(.2)	0(0)	.1(.4)	.1(.2)	0(0)	.1(.1)	.1(.9)	.1(.6)
241 ENCALYPTA PROCERA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
244 ENCALYPTA SP.	0(0)	0(0)	0(0)	0(0)	.1(.5)	0(0)	0(0)	0(0)
246 FISSIDENS OSMUNDOIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
450 FISSIDENS SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.2)
247 FUNARIA ARCTICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
250 HYLOCOMIUM SPLENDENS OBTUSIFOLIUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
251 HYPNUM BAMBERGERI	0(0)	0(0)	13.2(1.0)	.1(.1)	0(0)	0(0)	4.3(.8)	0(0)
252 HYPNUM CUPRESSIFORME	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
253 HYPNUM PROCERRIMUM	0(0)	0(0)	0(0)	.1(.6)	.1(.5)	0(0)	0(0)	0(0)
254 HYPNUM REVOLUTUM	0(0)	0(0)	.2(.6)	0(0)	0(0)	0(0)	0(0)	0(0)
256 HYPNUM SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
257 LEPTOBRYUM PYRIFORME	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
258 MEESIA TRIQUETRA	8.0(1.0)	15.3(1.0)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.5)
259 MEESIA ULIGINOSA	0(0)	.5(.2)	.1(.2)	0(0)	0(0)	0(0)	.5(.5)	0(0)
444 MNIUM ANDREWSIANUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
260 MNIUM BLYTTII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
431 PLAGIOMNIUM ELLIPTICUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
262 MYURELLA JULACEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
264 ONCOPHORUS WAHLENBERGII	0(0)	0(0)	.1(1)	0(0)	0(0)	0(0)	1.1(.3)	0(0)
265 ORTHOTHECIUM CHRYSEUM	.1(.1)	1.0(.1)	.1(.5)	0(0)	.2(.3)	0(0)	.8(.7)	0(0)
268 PHILONOTIS FONTANA PUMILA	0(0)	0(0)	0(0)	0(0)	0(0)	4.0(1.0)	0(0)	0(0)
410 PLAGIOPUS OEDERIANA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
272 POGONATUM ALPINUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
446 POLYTRICHACEAE	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
275 POHLIA NUTANS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
404 POHLIA SP	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table B4 (cont'd). Raw species data for 1- × 10-m plots.
The units are percentage of cover, with frequency in parentheses.

	1501	1503	1504	1505	1507	1508	1510	1511
276 RHACOMITRIUM LANUGINOSUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
278 RHYTIDIUM RUGOSUM	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)	0(0)
279 SCORPIDIUM SCORPIOIDES	7.5(1.0)	3.2(.6)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
280 SCORPIDIUM TURGESCENS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.2(.2)
282 SPLACHNUM VASCULOSUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
283 STEGONIA LATIFOLIA PILIFERA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
285 TETRAPLODON MNIOIDES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
287 THUIDIUM ABIETINUM	0(0)	0(0)	.1(.2)	1.5(.6)	.1(.4)	0(0)	0(0)	0(0)
288 TIMMIA AUSTRIACA	.1(.1)	0(0)	.1(.2)	0(0)	0(0)	0(0)	0(0)	0(0)
289 TIMMIA MEGAPOLITANA BAVARICA	.1(.1)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
290 TIMMIA NORVEGICA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
291 TOMENTHYPNUM NITENS	.1(.1)	0(0)	21.5(1.0)	.1(.2)	.5(.5)	0(0)	29.5(1.0)	0(0)
292 TORTELLA ARCTICA	0(0)	0(0)	0(0)	0(0)	1.0(.3)	0(0)	0(0)	0(0)
296 TORTULA RURALIS	.1(.1)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)	0(0)
298 VOITIA HYPERBOREA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
903 UNKNOWN MOSS	0(0)	.1(.1)	1.0(.9)	.1(.4)	1.5(.3)	.1(.3)	.1(.5)	.5(.6)
LICHENS								
299 ALECTORIA NIGRICANS	0(0)	0(0)	0(0)	.1(.6)	0(0)	0(0)	0(0)	0(0)
300 ALECTORIA OCHROLEUCA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
307 CALOPLACA SP.	0(0)	0(0)	0(0)	.1(.9)	0(0)	0(0)	0(0)	0(0)
310 CETRARIA CUCULLATA	0(0)	0(0)	.1(.3)	.1(.8)	0(0)	0(0)	.1(.2)	0(0)
311 CETRARIA DELISEI	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)
312 CETRARIA ISLANDICA	0(0)	.1(.1)	.4(.7)	.5(.5)	0(0)	0(0)	1.7(.9)	0(0)
314 CETRARIA NIVALIS	0(0)	0(0)	0(0)	.1(.3)	0(0)	0(0)	0(0)	0(0)
315 CETRARIA RICHARDSONII	0(0)	0(0)	.1(.1)	.5(.5)	0(0)	0(0)	0(0)	0(0)
316 CETRARIA TILESII	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
385 CLADONIA GRACILIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
318 CLADONIA LEPIDOTA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
427 CLADONIA PHYLLOPHORA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
319 CLADONIA POCILLUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
320 CLADONIA SQUAMOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
322 CLADONIA SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
327 CORNICULARIA DIVERGENS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
328 DACTYLINA ARCTICA	0(0)	0(0)	.1(.8)	.2(.8)	0(0)	0(0)	.3(.6)	0(0)
329 DACTYLINA RAMULOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
330 EVERNIA PERFRAGILIS	0(0)	0(0)	0(0)	1.7(.9)	0(0)	0(0)	0(0)	0(0)
331 FULGENSIA BRACTEATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
332 GYALECTA FOVEOLARIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
334 HYPOGYMNIA SUBOBSCURA	0(0)	0(0)	0(0)	.3(.2)	0(0)	0(0)	0(0)	0(0)
336 LECANORA EPIBRYON	0(0)	0(0)	.1(.5)	12.6(1.0)	.1(.2)	0(0)	.1(.2)	0(0)
428 LECIDEA RAMULOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
339 LECIDEA VERNALIS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
393 LEPTOGIUM SINNUATUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
342 LOPADIUM FECUNDUM	0(0)	0(0)	0(0)	1.1(.8)	.1(.2)	0(0)	0(0)	0(0)
343 OCHROLECHIA FRIGIDA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
413 OCHROLECHIA FRIGIDA THELEPHO[illegible]ES	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
348 PELTIGERA APHTHOSA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	.5(.4)	0(0)
349 PELTIGERA CANINA S.L.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
353 PELTIGERA SPURIA SOREDIATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
418 PERTUSARIA CORIACEA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
358 PERTUSARIA DACTYLINA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
384 PERTUSARIA SP.	0(0)	0(0)	0(0)	0(0)	.1(.1)	0(0)	0(0)	0(0)
360 PHYSCONIA MUSCIGENA	0(0)	0(0)	0(0)	1.1(.4)	0(0)	0(0)	0(0)	0(0)
412 PSOROMA HYPNORUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
400 SOLORINA SP.	0(0)	0(0)	.1(.4)	0(0)	0(0)	0(0)	0(0)	0(0)
369 SPHAEROPHORUS GLOBOSUS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
370 STEREOCAULON ALPINUM	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
372 THAMNOLIA SUBULIFORMIS	0(0)	.1(.1)	7.0(1.0)	4.9(1.0)	.1(.3)	0(0)	2.7(1.0)	0(0)
429 TONINIA CUMULATA	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
375 XANTHORIA ELEGANS	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
403 UNKNOWN CRUSTOSE LICHEN	0(0)	0(0)	0(0)	.5(.5)	.1(.1)	0(0)	0(0)	0(0)
378 UNKNOWN FRUTICOSE LICHEN	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
379 NOSTOC COMMUNE	5.5(1.0)	3.7(.8)	0(0)	0(0)	0(0)	0(0)	0(0)	.1(.3)
380 NOSTOC SP.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

	1512	1516	1519
VASCULAR PLANTS			
2 ALOPECURUS ALPINUS ALPINUS	0(0)	0(0)	0(0)
3 ANDROSACE CHAMAEJASME LEHMANNIANA	0(0)	0(0)	0(0)
4 ANDROSACE SEPTENTRIONALIS	0(0)	0(0)	0(0)
5 ANEMONE PARVIFLORA	0(0)	0(0)	0(0)
6 ANEMONE RICHARDSONII	0(0)	0(0)	0(0)
9 ARCTAGROSTIS LATIFOLIA S.L.	0(0)	0(0)	0(0)
10 ARCTOPHILA FULVA	0(0)	0(0)	0(0)
12 ARMERIA MARITIMA ARCTICA	0(0)	0(0)	0(0)
13 ARTEMISIA ARCTICA ARCTICA	0(0)	0(0)	0(0)
14 ARTEMISIA BOREALIS	0(0)	0(0)	0(0)
15 ARTEMISIA GLOMERATA	0(0)	0(0)	0(0)
18 ASTRAGALUS ALPINUS	0(0)	0(0)	0(0)
19 ASTRAGALUS UMBELLATUS	0(0)	0(0)	0(0)
22 BRAYA PURPURASCENS	0(0)	0(0)	0(0)
23 BRAYA SP.	0(0)	0(0)	0(0)
24 BROMUS PUMPELLIANUS ARCTICUS	0(0)	0(0)	0(0)
25 CALTHA PALUSTRIS ARCTICA	0(0)	0(0)	0(0)
27 CARDAMINE DIGITATA	0(0)	0(0)	0(0)
28 CARDAMINE PRATENSIS ANGUSTIFOLIA	0(0)	0(0)	0(0)
29 CAREX AQUATILIS S.L	1.3(.3)	17.9(1.0)	0(0)
30 CAREX ATROFUSCA	0(0)	.9(.3)	0(0)
31 CAREX BIGELOWII	7.5(1.0)	0(0)	0(0)
33 CAREX MARINA	0(0)	0(0)	.8(.2)
35 CAREX MEMBRANACEA	5.4(.9)	.1(.1)	20.3(1.0)
36 CAREX MISANDRA MISANDRA	0(0)	.1(.2)	.1(.4)
37 CAREX RARIFLORA	0(0)	0(0)	0(0)
38 CAREX ROTUNDATA	0(0)	0(0)	0(0)
39 CAREX RUPESTRIS	0(0)	0(0)	0(0)
40 CAREX SAXATILIS LAXA	0(0)	0(0)	0(0)
41 CAREX SCIRPOIDEA	0(0)	0(0)	.2([illegible])
42 CAREX SUBSPATHACEA	0(0)	0(0)	0(0)
44 CAREX VAGINATA	0(0)	0(0)	0(0)

Table B4 (cont'd).

		1512	1516	1519
45	CAREX SP.	0(0)	1.6(.1)	.1(.1)
46	CASSIOPE TETRAGONA TETRAGONA	0(0)	0(0)	0(0)
47	CERASTIUM BEERINGIANUM BEERINGIANUM	0(0)	0(0)	0(0)
49	CHRYSANTHEMUM INTEGRIFOLIUM	0(0)	0(0)	.1(.1)
51	COCHLEARIA OFFICINALIS ARCTICA	0(0)	0(0)	0(0)
52	DESCHAMPSIA CAESPITOSA ORIENTALIS	0(0)	0(0)	0(0)
53	DRABA ALPINA	0(0)	0(0)	0(0)
56	DRABA LACTEA	0(0)	0(0)	0(0)
57	DRABA SP.	0(0)	0(0)	0(0)
58	DRYAS INTEGRIFOLIA INTEGRIFOLIA	20.6(1.0)	1(.5)	[illegible](1.0)
59	DUPONTIA FISHERI S.L.	0(0)	.1(1.0)	0(0)
61	ELYMUS ARENARIUS MOLLIS VILLOSISSIMUS	0(0)	0(0)	0(0)
62	EPILOBIUM LATIFOLIUM	0(0)	0(0)	0(0)
63	EQUISETUM ARVENSE	0(0)	0(0)	0(0)
64	EQUISETUM SCIRPOIDES	0(0)	0(0)	0(0)
65	EQUISETUM VARIEGATUM	.1(.3)	4.3(1.0)	8(.2)
66	ERIGERON ERIOCEPHALUS	0(0)	0(0)	0(0)
399	ERIOPHORUM ANGUSTIFOLIUM S.L.	9.2(1.0)	5.9(1.0)	24.1(1.0)
69	ERIOPHORUM RUSSEOLUM	0(0)	0(0)	0(0)
70	ERIOPHORUM SCHEUCHZERI SCHEUCHZERI	0(0)	0(0)	0(0)
72	ERIOPHORUM VAGINATUM	0(0)	0(0)	0(0)
73	EUTREMA EDWARDSII	0(0)	0(0)	.1(.2)
74	FESTUCA BAFFINENSIS	0(0)	0(0)	0(0)
76	FESTUCA RUBRA	0(0)	0(0)	0(0)
78	GENTIANELLA PROPINQUA PROPINQUA	0(0)	0(0)	0(0)
79	HIEROCHLOE PAUCIFLORA	0(0)	0(0)	0(0)
83	JUNCUS BIGLUMIS	0(0)	.1(.2)	0(0)
84	JUNCUS CASTANEUS CASTANEUS	0(0)	0(0)	0(0)
86	KOBRESIA MYOSUROIDES	0(0)	0(0)	0(0)
89	LESQUERELLA ARCTICA	0(0)	0(0)	0(0)
90	LLOYDIA SEROTINA	0(0)	0(0)	0(0)
91	LUZULA ARCTICA	0(0)	0(0)	0(0)
92	LUZULA CONFUSA	0(0)	0(0)	0(0)
94	MINUARTIA ARCTICA	0(0)	0(0)	0(0)
96	MINUARTIA RUBELLA	0(0)	0(0)	0(0)
100	OXYTROPIS BOREALIS	0(0)	0(0)	0(0)
103	OXYTROPIS NIGRESCENS BRYOPHILA	0(0)	0(0)	0(0)
105	PAPAVER LAPPONICUM OCCIDENTALE	0(0)	0(0)	0(0)
106	PAPAVER MACOUNII	0(0)	0(0)	0(0)
108	PARRYA NUDICAULIS NUDICAULIS	0(0)	0(0)	0(0)
109	PEDICULARIS CAPITATA	0(0)	0(0)	0(0)
110	PEDICULARIS LANATA	.1(.1)	0(0)	.1(.5)
112	PEDICULARIS SUDETICA INTERIOR	0(0)	0(0)	0(0)
381	PEDICULARIS SUDETICA S.L.	0(0)	.7(1.0)	0(0)
114	PETASITES FRIGIDUS	0(0)	0(0)	0(0)
117	POA ALPIGENA	0(0)	0(0)	0(0)
118	POA ARCTICA	0(0)	0(0)	0(0)
119	POA GLAUCA	0(0)	0(0)	0(0)
121	POA SP.	0(0)	0(0)	0(0)
122	POLEMONIUM BOREALE	0(0)	0(0)	0(0)
124	POLYGONUM VIVIPARUM	.1(.8)	.1(.5)	.1(.8)
127	POTENTILLA UNIFLORA	0(0)	0(0)	0(0)
129	PUCCINELLIA ANDERSONII	0(0)	0(0)	0(0)
130	PUCCINELLIA PHRYGANODES	0(0)	0(0)	0(0)
131	PYROLA GRANDIFLORA	0(0)	0(0)	0(0)
133	RANUNCULUS PALLASII	0(0)	0(0)	0(0)
134	RANUNCULUS PEDATIFIDUS AFFINIS	0(0)	0(0)	0(0)
137	SAGINA INTERMEDIA	0(0)	0(0)	0(0)
139	SALIX ARCTICA	2.3(1.0)	.3(.4)	.1(1.0)
140	SALIX LANATA RICHARDSONII	.2(.2)	.1(.1)	.1(.1)
141	SALIX OVALIFOLIA OVALIFOLIA	0(0)	.1(.6)	0(0)
142	SALIX PLANIFOLIA PULCHRA PULCHRA	0(0)	0(0)	0(0)
143	SALIX RETICULATA RETICULATA	.5(.6)	.1(.1)	2.0(.9)
144	SALIX ROTUNDIFOLIA ROTUNDIFOLIA	0(0)	0(0)	0(0)
145	SAUSSUREA ANGUSTIFOLIA	0(0)	0(0)	0(0)
146	SAXIFRAGA CAESPITOSA	0(0)	0(0)	0(0)
147	SAXIFRAGA CERNUA	0(0)	0(0)	0(0)
148	SAXIFRAGA FOLIOLOSA	0(0)	0(0)	0(0)
149	SAXIFRAGA HIERACIFOLIA	0(0)	0(0)	0(0)
150	SAXIFRAGA HIRCULUS PROPINQUA	1(.3)	.1(.1)	0(0)
151	SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	.1(.6)	.1(.2)	.5(.9)
154	SENECIO ATROPURPUREUS FRIGIDUS	0(0)	0(0)	0(0)
156	SENECIO RESEDIFOLIUS	0(0)	0(0)	0(0)
157	SILENE ACAULIS	0(0)	0(0)	0(0)
159	SILENE WAHLBERGELLA ARCTICA	0(0)	0(0)	0(0)
160	STELLARIA HUMIFUSA	0(0)	0(0)	0(0)
161	STELLARIA LAETA	0(0)	0(0)	0(0)
164	TARAXACUM PHYMATOCARPUM	0(0)	0(0)	0(0)
165	THALICTRUM ALPINUM	0(0)	0(0)	0(0)
168	TRISETUM SPICATUM SPICATUM	0(0)	0(0)	0(0)
169	UTRICULARIA VULGARIS MACRORHIZA	0(0)	0(0)	0(0)
172	WILHELMSIA PHYSODES	0(0)	0(0)	0(0)
901	UNKNOWN MONOCOT	0(0)	0(0)	.1(1)
902	UNKNOWN DICOT	.1(3)	0(0)	0(0)
	LIVERWORTS			
173	ANEURA PINGUIS	.1(.2)	.5(.2)	0(0)
426	ANASTROPHYLLUM MINUTUM	0(0)	0(0)	0(0)
175	BLEPHAROSTOMA TRICHOPHYLLUM BREVIRETE	0(0)	0(0)	0(0)
397	CALYPOGEIA MUELLERIANA	0(0)	0(0)	0(0)
460	GYMNOCOLEA INFLATA	0(0)	0(0)	0(0)
441	HARPANTHUS FLOTOWIANUS	0(0)	0(0)	0(0)
405	LOPHOZIA BINSTEADII	0(0)	0(0)	0(0)
433	LOPHOZIA HETEROCOLPA	0(0)	0(0)	0(0)
407	LOPHOZIA QUADRILOBA	0(0)	0(0)	0(0)
486	LOPHOZIA SP	0(0)	0(0)	0(0)
182	PLAGIOCHILA ARCTICA	0(0)	0(0)	0(0)
181	PTILIDIUM CILIARE	0(0)	0(0)	0(0)
185	RADULA PROLIFERA	0(0)	0(0)	0(0)
406	SCAPANIA SIMMONSII	0(0)	0(0)	0(0)
188	UNKNOWN LEAFY LIVERWORTS	0(0)	0(0)	1.2(7)
189	UNKNOWN THALLOID LIVERWORTS	0(0)	0(0)	0(0)

Table B4 (cont'd). Raw species data for 1- × 10-m plots.
The units are percentage of cover, with frequency in parentheses.

	1512	1516	1519
MOSSES			
192 AULACOMNIUM ACUMINATUM	0(0)	0(0)	0(0)
193 AULACOMNIUM PALUSTRE	0(0)	0(0)	0(0)
194 AULACOMNIUM TURGIDUM	0(0)	0(0)	0(0)
448 BRACHYTHECIACEAE	2.2(.4)	0(0)	.5(6)
432 BRACHYTHECIUM GROENLANDICUM	0(0)	0(0)	0(0)
196 BRACHYTHECIUM TURGIDUM	0(0)	0(0)	0(0)
440 BRYUM ALGOVICUM	0(0)	0(0)	0(0)
199 BRYUM ARCTICUM	0(0)	0(0)	0(0)
205 BRYUM STENOTRICHUM	0(0)	0(0)	0(0)
439 BRYUM TORTIFOLIUM	0(0)	0(0)	0(0)
206 BYRUM WRIGHTII	0(0)	0(0)	0(0)
383 BRYUM SP.	.1(.3)	.5(.1)	0(0)
209 CALLIERGON RICHARDSONII ROBUSTUM	1.0(.6)	4.0(.9)	.2(.5)
212 CALLIERGON SP.	0(0)	0(0)	0(0)
213 CAMPYLIUM STELLATUM	2.8(1.0)	.1(.1)	4.7(.5)
214 CATOSCOPIUM NIGRITUM	7.5(.3)	.5(.1)	.1(.2)
215 CERATODON PURPUREUS	0(0)	0(0)	0(0)
216 CINCLIDIUM ARCTICUM	0(0)	0(0)	0(0)
217 CINCLIDIUM LATIFOLIUM	1.0(.5)	13.0(.9)	.1(.3)
411 CINCLIDIUM STYGIUM	0(0)	0(0)	0(0)
449 CINCLIDIUM SP.	0(0)	0(0)	0(0)
218 CIRRIPHYLLUM CIRROSUM	0(0)	0(0)	0(0)
219 CRATONEURON ARCTICUM	0(0)	0(0)	0(0)
221 CTENIDIUM MOLLUSCUM	0(0)	0(0)	0(0)
223 CYRTOMNIUM HYMENOPHYLLUM	0(0)	0(0)	0(0)
227 DICRANUM ANGUSTUM	0(0)	0(0)	0(0)
228 DICRANUM ELONGATUM	0(0)	0(0)	0(0)
390 DICRANUM SP.	0(0)	0(0)	0(0)
229 DIDYMODON ASPERIFOLIUS	0(0)	0(0)	.1(.2)
230 DISTICHIUM CAPILLACEUM	2.1(1.0)	8.7(.8)	7.7(.9)
232 DISTICHIUM INCLINATUM	0(0)	0(0)	0(0)
233 DITRICHUM FLEXICAULE	20.5(.9)	.1(.1)	27.3(1.0)
236 DREPANOCLADUS BREVIFOLIUS	7.5(1.0)	63.5(1.0)	0(0)
237 DREPANOCLADUS REVOLVENS	0(0)	0(0)	0(0)
238 DREPANOCLADUS UNCINATUS	0(0)	0(0)	0(0)
239 DREPANOCLADUS SP.	0(0)	0(0	0(0)
240 ENCALYPTA ALPINA	.5(.7)	.1(.1	0(0)
241 ENCALYPTA PROCERA	0(0)	0(0)	0(0)
244 ENCALYPTA SP.	.1(.3)	0(0)	[illegible](.9)
246 FISSIDENS OSMUNDOIDES	0(0)	0(0)	0(0)
450 FISSIDENS SP.	0(0)	0(0)	0(0)
247 FUNARIA ARCTICA	0(0)	0(0)	0( )
250 HYLOCOMIUM SPLENDENS OBTUSIFOLIUM	0(0)	0(0)	0(0)
251 HYPNUM BAMBERGERI	.6(.1)	0(0)	6.6(1.0)
252 HYPNUM CUPRESSIFORME	0(0)	0(0)	0(0)
253 HYPNUM PROCERRIMUM	.8(.5)	0(0)	[illegible].7(1.0)
254 HYPNUM REVOLUTUM	0(0)	0(0)	0(0)
256 HYPNUM SP.	0(0)	0(0)	0(0)
257 LEPTOBRYUM PYRIFORME	0(0)	0(0)	0(0)
258 MEESIA TRIQUETRA	0(0)	5.2(.9)	.1(.1)
259 MEESIA ULIGINOSA	.3(4)	.1(.1)	.1(.1)
444 MNIUM ANDREWSIANUM	0(0)	0(0)	0(0)
260 MNIUM BLYTTII	0(0)	0(0)	0(0)
431 PLAGIOMNIUM ELLIPTICUM	0(0)	0(0)	0(0)
262 MYURELLA JULACEA	0(0)	0(0)	0(0)
264 ONCOPHORUS WAHLENBERGII	.2(.1)	0(0)	.1(.3)
265 ORTHOTHECIUM CHRYSEUM	12.6(.9)	.1(.1)	5.7(1.0)
268 PHILONOTIS FONTANA PUMILA	0(0)	0(0)	0(0)
410 PLAGIOPUS OEDERIANA	0(0)	0(0)	0(0)
272 POGONATUM ALPINUM	0(0)	0(0)	0(0)
446 POLYTRICHACEAE	0(0)	0(0)	0(0)
275 POHLIA NUTANS	0(0)	0(0)	0(0)
404 POHLIA SP.	0(0)	0(0)	0(0)
276 RHACOMITRIUM LANUGINOSUM	0(0)	0(0)	0(0)
278 RHYTIDIUM RUGOSUM	0(0)	0(0)	0(0)
279 SCORPIDIUM SCORPIOIDES	0(0)	0(0)	0(0)
280 SCORPIDIUM TURGESCENS	0(0)	0(0)	0(0)
282 SPLACHNUM VASCULOSUM	0(0)	0(0)	0(0)
283 STEGONIA LATIFOLIA PILIFERA	0(0)	0(0)	0(0)
285 TETRAPLODON MNIOIDES	0(0)	0(0)	0(0)
287 THUIDIUM ABIETINUM	0(0)	0(0)	0(0)
288 TIMMIA AUSTRIACA	0(0)	0(0)	0(0)
289 TIMMIA MEGAPOLITANA BAVARICA	0(0)	0(0)	0(0)
290 TIMMIA NORVEGICA	0(0)	0(0)	0(0)
291 TOMENTHYPNUM NITENS	2.2(.8)	0(0)	6.2(1.0)
292 TORTELLA ARCTICA	0(0)	0(0)	0(0)
296 TORTULA RURALIS	0(0)	0(0)	0(0)
298 VOITIA HYPERBOREA	0(0)	0(0)	0(0)
903 UNKNOWN MOSS	2.5(.5)	1.5(.3)	.1(.9)
LICHENS			
299 ALECTORIA NIGRICANS	0(0)	0(0)	0(0)
300 ALECTORIA OCHROLEUCA	0(0)	0(0)	0(0)
307 CALOPLACA SP.	.1(.1)	0(0)	0(0)
310 CETRARIA CUCULLATA	0(0)	0(0)	0(0)
311 CETRARIA DELISEI	0(0)	0(0)	0(0)
312 CETRARIA ISLANDICA	.1(.1)	0(0)	0(0)
314 CETRARIA NIVALIS	0(0)	0(0)	0(0)
315 CETRARIA RICHARDSONII	0(0)	0(0)	0(0)
316 CETRARIA TILESII	0(0)	0(0)	0(0)
385 CLADONIA GRACILIS	0(0)	0(0)	0(0)
318 CLADONIA LEPIDOTA	0(0)	0(0)	0(0)
427 CLADONIA PHYLLOPHORA	0(0)	0(0)	0(0)
319 CLADONIA POCILLUM	0(0)	0(0)	0(0)
320 CLADONIA SQUAMOSA	0(0)	0(0)	0(0)
322 CLADONIA SP.	0(0)	0(0)	0(0)
327 CORNICULARIA DIVERGENS	0(0)	0(0)	0(0)
328 DACTYLINA ARCTICA	0(0)	0(0)	1(2)
329 DACTYLINA RAMULOSA	0(0)	0(0)	0(0)
330 EVERNIA PERFRAGILIS	0(0)	0(0)	0(0)
331 FULGENSIA BRACTEATA	0(0)	0(0)	0(0)

Table B4 (cont'd).

	1512	1516	1519
332 GYALECTA FOVEOLARIS	0(0)	0(0)	0(0)
334 HYPOGYMNIA SUBOBSCURA	0(0)	0(0)	0(0)
336 LECANORA EPIBRYON	1(.4)	0(0)	.1(.2)
428 LECIDEA RAMULOSA	0(0)	0(0)	0(0)
339 LECIDEA VERNALIS	0(0)	0(0)	0(0)
393 LEPTOGIUM SINNUATUM	0(0)	0(0)	0(0)
342 LOPADIUM FECUNDUM	0(0)	0(0)	0(0)
343 OCHROLECHIA FRIGIDA	0(0)	0(0)	0(0)
413 OCHROLECHIA FRIGIDA THELEPHOROIDES	0(0)	0(0)	0(0)
348 PELTIGERA APHTHOSA	0(0)	0(0)	1(.2)
349 PELTIGERA CANINA S.L.	0(0)	0(0)	1(.1)
353 PELTIGERA SPURIA SOREDIATA	0(0)	0(0)	0(0)
418 PERTUSARIA CORIACEA	0(0)	0(0)	0(0)
359 PERTUSARIA DACTYLINA	0(0)	0(0)	0(0)
384 PERTUSARIA SP.	0(0)	0(0)	0(0)
360 PHYSCONIA MUSCIGENA	0(0)	0(0)	0(0)
412 PSOROMA HYPNORUM	0(0)	0(0)	0(0)
400 SOLORINA SP.	.2(.3)	0(0)	1(.1)
369 SPHAEROPHORUS GLOBOSUS	0(0)	0(0)	0(0)
370 STEREOCAULON ALPINUM	0(0)	0(0)	0(0)
372 THAMNOLIA SUBULIFORMIS	.1(.5)	0(0)	1.7(.7)
429 TONINIA CUMULATA	0(0)	0(0)	0(0)
375 XANTHORIA ELEGANS	0(0)	0(0)	0(0)
403 UNKNOWN CRUSTOSE LICHEN	0(0)	0(0)	0(0)
378 UNKNOWN FRUTICOSE LICHEN	.1(.1)	0(0)	0(0)
379 NOSTOC COMMUNE	0(0)	8.0(1.0)	0(0)
380 NOSTOC SP.	0(0)	0(0)	.1(.1)

Table B5. Raw species data for 1- × 1-m plots.
The units are percentage of cover.

	030A	060A	0801	1002	1103	1104	1105	1106	1107	1203	1204	1301	1302	1303	1304
VASCULAR PLANTS															
2 ALOPECURUS ALPINUS ALPINUS	0	0	0	0	0	0	0	0	5.0	0	4.0	0	0	0	0
3 ANDROSACE CHAMAEJASME LEHMANNIANA	0	0	0	0	0	0	0	.1	0	0	0	0	0	0	0
4 ANDROSACE SEPTENTRIONALIS	0	0	0	2.0	0	0	0	0	0	0	0	0	0	0	0
5 ANEMONE PARVIFLORA	0	0	0	0	0	0	0	3.0	.1	0	0	0	0	0	0
6 ANEMONE RICHARDSONII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9 ARCTAGROSTIS LATIFOLIA S.L.	0	0	1.0	.1	0	0	0	.1	8.0	0	0	0	0	0	0
10 ARCTOPHILA FULVA	0	30.0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 ARMERIA MARITIMA ARCTICA	0	0	0	0	0	0	.1	0	0	0	0	0	0	0	0
13 ARTEMISIA ARCTICA ARCTICA	0	0	0	0	0	0	0	1.0	0	0	0	0	0	0	0
14 ARTEMISIA BOREALIS	0	0	0	0	0	0	1.0	0	0	0	0	0	0	0	0
15 ARTEMISIA GLOMERATA	0	0	0	0	0	0	1.0	0	0	0	0	0	0	0	0
18 ASTRAGALUS ALPINUS	0	0	0	0	0	0	0	8.0	0	0	0	0	0	0	0
19 ASTRAGULUS UMBELLATUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22 BRAYA PURPURASCENS	0	0	0	0	0	8.0	0	0	0	0	0	5.0	0	0	0
23 BRAYA SP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24 BROMUS PUMPELLIANUS ARCTICUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25 CALTHA PALUSTRIS ARCTICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27 CARDAMINE DIGITATA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28 CARDAMINE PRATENSIS ANGUSTIFOLIA	0	0	0	0	0	0	0	0	0	.1	0	0	0	0	0
29 CAREX AQUATILIS S.L.	38.0	4.0	0	0	30.0	0	0	0	0	60.0	25.0	0	0	18.0	70.0
30 CAREX ATROFUSCA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31 CAREX BIGELOWII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33 CAREX MARINA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35 CAREX MEMBRANACEA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36 CAREX MISANDRA MISANDRA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37 CAREX RARIFLORA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38 CAREX ROTUNDATA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39 CAREX RUPESTRIS	0	0	3.0	0	0	0	0	0	0	0	0	0	0	0	0
40 CAREX SAXATILIS LAXA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41 CAREX SCIRPOIDEA	0	0	0	0	0	0	0	0	0	0	.1	0	0	0	0
42 CAREX SUBSPATHACEA	0	0	0	0	0	0	0	0	0	0	0	0	65.0	0	0
44 CAREX VAGINATA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45 CAREX SP.	0	0	2.0	0	0	0	0	3.0	0	0	0	0	0	0	0
46 CASSIOPE TETRAGONA TETRAGONA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47 CERASTIUM BEERINGIANUM BEERINGIANUM	0	0	0	3.0	0	0	0	0	0	0	0	0	0	0	0
49 CHRYSANTHEMUM INTEGRIFOLIUM	0	0	.1	0	0	0	0	0	0	0	0	0	0	0	0
51 COCHLEARIA OFFICINALIS ARCTICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52 DESCHAMPSIA CAESPITOSA ORIENTALIS	0	0	0	0	0	0	0	0	.1	0	0	0	0	0	0
53 DRABA ALPINA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56 DRABA LACTEA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57 DRABA SP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58 DRYAS INTEGRIFOLIA INTEGRIFOLIA	23.0	0	10.0	.1	0	0	0	25.0	0	0	8.0	0	0	0	0
59 DUPONTIA FISHERI S.L.	0	0	0	0	0	0	0	0	1.0	7.0	0	0	0	0	0
61 ELYMUS ARENARIUS MOLLIS VILLOSISSIMUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62 EPILOBIUM LATIFOLIUM	0	0	0	0	0	23.0	1.0	4.0	0	0	0	0	0	0	0
63 EQUISETUM ARVENSE	0	0	0	0	0	0	0	0	35.0	0	0	0	0	0	0
64 EQUISETUM SCIRPOIDES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65 EQUISETUM VARIEGATUM	1.0	0	.1	0	10.0	0	0	2.0	1.0	0	2.0	0	0	0	0
66 ERIGERON ERIOCEPHALUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
399 ERIOPHORUM ANGUSTIFOLIUM S.L.	4.0	0	1.0	0	5.0	0	0	1.0	0	0	0	0	0	50.0	3.0
69 ERIOPHORUM RUSSEOLUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70 ERIOPHORUM SCHEUCHZERI SCHEUCHZERI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72 ERIOPHORUM VAGINATUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73 EUTREMA EDWARDSII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74 FESTUCA BAFFINENSIS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76 FESTUCA RUBRA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78 GENTIANELLA PROPINQUA PROPINQUA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79 HIEROCHLOE PAUCIFLORA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83 JUNCUS BIGLUMIS	0	0	.1	0	0	0	0	0	0	0	0	0	0	0	0
84 JUNCUS CASTANEUS CASTANEUS	0	0	0	0	0	0	0	0	.1	0	0	0	0	0	0
86 KOBRESIA MYOSUROIDES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
89 LESQUERELLA ARCTICA	0	0	0	0	0	0	1.0	0	0	0	0	0	0	0	0
90 LLOYDIA SEROTINA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
91 LUZULA ARCTICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92 LUZULA CONFUSA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
94 MINUARTIA ARCTICA	0	0	1.0	0	0	0	0	0	0	0	0	0	0	0	0
96 MINUARTIA RUBELLA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100 OXYTROPIS BOREALIS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
103 OXYTROPIS NIGRESCENS BRYOPHILA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105 PAPAVER LAPPONICUM OCCIDENTALE	0	0	0	[illegible]	0	0	0	0	0	0	0	0	0	0	0
106 PAPAVER MACOUNII	0	0	0	[illegible]	0	0	0	0	0	0	0	0	0	0	0
108 PARRYA NUDICAULIS NUDICAULIS	0	0	0	[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0
109 PEDICULARIS CAPITATA	0	0	0	[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0
110 PEDICULARIS LANATA	0	0	.1	0	0	0	0	.1	0	0	0	0	0	0	0
112 PEDICULARIS SUDETICA INTERIOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
381 PEDICULARIS SUDETICA S.L.	.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
114 PETASITES FRIGIDUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
117 POA ALPIGENA	0	0	0	50.0	0	0	0	0	0	0	0	0	0	0	0
118 POA ARCTICA	0	0	0	0	0	0	0	0	0	0	0	0	0	1.0	0
119 POA GLAUCA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
121 POA SP.	0	0	0	0	0	.1	0	0	0	0	2.0	0	0	0	0
122 POLEMONIUM BOREALE	0	0	0	0	0	0	0	.1	0	0	0	0	0	0	0
124 POLYGONUM VIVIPARUM	.1	0	1.0	0	1.0	.1	.1	1.0	.1	0	2.0	0	0	0	0
127 POTENTILLA UNIFLORA	0	0	0	1.0	0	0	0	0	0	0	0	0	0	0	0
129 PUCCINELLIA ANDERSONII	0	0	0	0	0	0	0	0	0	0	0	3.0	0	0	0
130 PUCCINELLIA PHRYGANODES	0	0	0	0	0	0	0	0	0	0	0	0	30.0	0	0
131 PYROLA GRANDIFLORA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
133 RANUNCULUS PALLASII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
134 RANUNCULUS PEDATIFIDUS AFFINIS	0	0	0	.1	0	0	0	0	0	0	0	0	0	0	0
137 SAGINA INTERMEDIA	0	0	0	.1	0	0	0	0	0	0	0	0	0	0	0
139 SALIX ARCTICA	12.0	0	0	0	0	1.0	0	0	1.0	0	0	0	0	0	0
140 SALIX LANATA RICHARDSONII	8.0	0	0	0	75.0	0	0	0	0	0	0	0	0	0	0
141 SALIX OVALIFOLIA OVALIFOLIA	0	0	0	0	2.0	0	1	8.0	13.0	2.0	1.0	0	0	0	0
142 SALIX PLANIFOLIA PULCHRA PULCHRA	0	0	0	0	0	0	0	0	0	0	0	0	0	20.0	0
143 SALIX RETICULATA RETICULATA	8.0	0	.1	0	.1	1.0	0	0	0	0	0	0	0	0	0
144 SALIX ROTUNDIFOLIA ROTUNDIFOLIA	0	0	0	0	0	1.0	0	0	0	0	0	0	0	0	0
145 SAUSSUREA ANGUSTIFOLIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
146 SAXIFRAGA CAESPITOSA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
147 SAXIFRAGA CERNUA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
148 SAXIFRAGA FOLIOLOSA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
149 SAXIFRAGA HIERACIFOLIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
150 SAXIFRAGA HIRCULUS PROPINQUA	0	0	0	0	0	0	0	0	0	.1	0	0	0	0	0

Table B5 (cont'd). Raw species data for 1- × 1-m plots.
The units are percentage of cover.

	030A	060A	0801	1002	1103	1104	1105	1106	1107	1203	1204	1301	1302	1303	1304
151 SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	0	0	12.0	0	0	0	.1	6.0	0	0	0	0	0	0	0
154 SENECIO ATROPURPUREUS FRIGIDUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
156 SENECIO RESEDIFOLIUS	0	0	0	0	0	0	0	.1	0	0	0	0	0	0	0
157 SILENE ACAULIS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
159 SILENE WAHLBERGELLA ARCTICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
160 STELLARIA HUMIFUSA	0	0	0	0	0	0	0	0	0	0	0	0	.1	0	0
161 STELLARIA LAETA	0	0	0	0	0	0	0	.1	0	0	1.0	0	0	0	0
164 TARAXACUM PHYMATOCARPUM	0	0	0	4.0	0	0	0	0	0	0	0	0	0	0	0
165 *THALICTRUM ALPINUM*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
168 TRISETUM SPICATUM SPICATUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
169 UTRICULARIA VULGARIS MACRORHIZA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
172 WILHELMSIA PHYSODES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
901 UNKNOWN MONOCOT	0	0	0	0	0	0	0	0	.1	0	1.0	.1	0	0	0
902 UNKNOWN DICOT	0	0	.1	.1	0	0	0	0	.1	0	0	0	0	0	0
LIVERWORTS															
173 ANEURA PINGUIS	.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
426 ANASTROPHYLLUM MINUTUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
175 BLEPHAROSTOMA TRICHOPHYLLUM BREVIRETE	.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
397 CALYPOGEIA MUELLERIANA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
460 GYMNOCOLEA INFLATA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
441 HARPANTHUS FLOTOWIANUS	.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
405 LOPHOZIA BINSTEADII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
433 LOPHOZIA HETEROCOLPA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
407 LOPHOZIA QUADRILOBA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
436 LOPHOZIA SP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
162 PLAGIOCHILA ARCTICA	.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
184 PTILIDIUM CILIARE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
185 RADULA PROLIFERA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
406 SCAPANIA SIMMONSII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
188 UNKNOWN LEAFY LIVERWORTS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
189 UNKNOWN THALLOID LIVERWORTS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MOSSES															
192 AULACOMNIUM ACUMINATUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
193 AULACOMNIUM PALUSTRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
194 AULACOMNIUM TURGIDUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
448 BRACHYTHECIACEAE	5.0	0	.1	0	0	0	0	0	0	0	0	0	0	1.0	0
432 BRACHYTHECIUM GROENLANDICUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
196 *BRACHYTHECIUM TURGIDUM*	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
440 BRYUM ALGOVICUM	.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
199 BRYUM ARCTICUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
205 BRYUM STENOTRICHUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
439 BRYUM TORTIFOLIUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
206 BYRUM WRIGHTII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
383 BRYUM SP.	2.0	0	0	15.0	10.0	0	0	5.0	1.0	.1	0	.1	0	0	.1
209 CALLIERGON RICHARDSONII ROBUSTUM	1.0	0	0	0	5.0	0	0	0	0	45.0	0	.1	0	0	0
212 CALLIERGON SP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
213 CAMPYLIUM STELLATUM	10.0	0	0	0	15.0	0	0	0	0	1.0	.1	0	.1	0	0
214 CATOSCOPIUM NIGRITUM	.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
215 CERATODON PURPUREUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
216 CINCLIDIUM ARCTICUM	1.0	0	0	0	2.0	0	0	0	0	1.0	0	0	0	0	0
217 CINCLIDIUM LATIFOLIUM	.1	0	0	0	0	0	0	0	0	1.0	0	0	0	0	0
411 CINCLIDIUM STYGIUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
449 CINCLIDIUM SP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
218 CIRRIPHYLLUM CIRROSUM	5.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
219 CRATONEURON ARCTICUM	0	0	0	0	.1	0	0	0	0	0	0	0	0	0	0
221 CTENIDIUM MOLLUSCUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
223 CYRTOMNIUM HYMENOPHYLLUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
227 DICRANUM ANGUSTUM	0	0	0	0	0	0	0	0	0	0	0	0	0	2.0	0
228 DICRANUM ELONGATUM	0	0	0	0	0	0	0	0	0	0	0	0	0	15.0	0
390 DICRANUM SP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
229 DIDYMODON ASPERIFOLIUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
230 DISTICHIUM CAPILLACEUM	10.0	0	.1	0	5.0	0	0	20.0	0	.1	0	0	0	0	0
232 DISTICHIUM INCLINATUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
233 DITRICHUM FLEXICAULE	3.0	0	.1	0	0	0	0	2.0	0	0	0	0	0	0	0
236 DREPANOCLADUS BREVIFOLIUS	15.0	0	0	0	5.0	0	0	0	0	55.0	0	0	0	0	0
237 DREPANOCLADUS REVOLVENS	.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
238 DREPANOCLADUS UNCINATUS	0	0	.1	0	0	0	0	0	0	0	0	0	0	0	0
239 DREPANOCLADUS SP.	0	0	0	0	0	0	0	0	0	0	0	0	0	1.0	0
240 *ENCALYPTA ALPINA*	0	0	.1	0	0	0	0	0	0	0	0	0	0	0	0
241 ENCALYPTA PROCERA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
244 ENCALYPTA SP.	0	0	0	.1	0	0	0	0	0	.1	.1	.1	0	0	0
246 FISSIDENS OSMUNDOIDES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
450 FISSIDENS SP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
247 FUNARIA ARCTICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
250 HYLOCOMIUM SPLENDENS OBTUSIFOLIUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
251 HYPNUM BAMBERGERI	2.0	0	.1	0	0	0	0	0	0	0	0	0	0	0	0
252 HYPNUM CUPRESSIFORME	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
253 HYPNUM PROCERRIMUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
254 HYPNUM REVOLUTUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
256 HYPNUM SP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
257 LEPTOBRYUM PYRIFORME	0	0	0	0	0	.1	0	0	0	0	0	0	0	0	0
258 MEESIA TRIQUETRA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
259 MEESIA ULIGINOSA	0	0	0	0	0	0	0	0	0	.1	0	0	0	0	0
444 MNIUM ANDREWSIANUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
260 MNIUM BLYTTII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.1
431 PLAGIOMNIUM ELLIPTICUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
262 MYURELLA JULACEA	.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
264 ONCOPHORUS WAHLENBERGII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
265 ORTHOTHECIUM CHRYSEUM	2.0	0	0	0	.1	0	0	0	0	0	0	0	0	0	0
268 PHILONOTIS FONTANA PUMILA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
410 *PLAGIOPUS OEDERIANA*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
272 POGONATUM ALPINUM	0	0	0	0	0	0	0	0	0	0	0	0	0	14.0	0
446 POLYTRICHACEAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
275 POHLIA NUTANS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
404 POHLIA SP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
276 RHACOMITRIUM LANUGINOSUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
278 RHYTIDIUM RUGOSUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
279 SCORPIDIUM SCORPIOIDES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
280 SCORPIDIUM TURGESCENS	.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
282 *SPLACHNUM VASCULOSUM*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B5 (cont'd).

	030A	060A	0801	1002	1103	1104	1105	1106	1107	1203	1204	1301	1302	1303	1304
283 STEGONIA LATIFOLIA PILIFERA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
285 TETRAPLODON MNIOIDES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
287 THUIDIUM ABIETINUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
288 TIMMIA AUSTRIACA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
289 TIMMIA MEGAPOLITANA BAVARICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
290 TIMMIA NORVEGICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
291 TOMENTHYPNUM NITENS	40.0	0	0	.1	0	0	0	0	0	0	0	.1	0	0	0
292 TORTELLA ARCTICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
296 TORTULA RURALIS	0	0	0	.1	0	0	0	0	0	0	0	0	0	0	0
298 VOITIA HYPERBOREA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
903 UNKNOWN MOSS	0	0	0	.1	.1	0	0	2.0	.1	1.0	.1	1.0	0	0	0
LICHENS															
299 ALECTORIA NIGRICANS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
300 ALECTORIA OCHROLEUCA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
307 CALOPLACA SP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
310 CETRARIA CUCULLATA	0	0	.1	0	0	0	0	0	0	0	0	0	0	0	0
311 CETRARIA DELISEI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
312 CETRARIA ISLANDICA	0	0	.1	0	0	0	0	0	0	0	0	0	0	.1	0
314 CETRARIA NIVALIS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
315 CETRARIA RICHARDSONII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
316 CETRARIA TILESII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
385 CLADONIA GRACILIS	0	0	0	0	0	0	0	0	0	0	0	0	0	.1	0
318 CLADONIA LEPIDOTA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
427 CLADONIA PHYLLOPHORA	0	0	0	0	0	0	0	0	0	0	0	0	0	.1	0
319 CLADONIA POCILLUM	0	0	1.0	0	0	0	0	0	0	0	0	0	0	0	0
320 CLADONIA SQUAMOSA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
322 CLADONIA SP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
327 CORNICULARIA DIVERGENS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
328 DACTYLINA ARCTICA	.1	0	1.0	0	0	0	0	0	0	0	0	0	0	2.0	0
329 DACTYLINA RAMULOSA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
330 EVERNIA PERFRAGILIS	0	0	0	.1	0	0	0	0	0	0	0	0	0	0	0
331 FULGENSIA BRACTEATA	0	0	0	0	0	0	0	0	0	0	0	1.0	0	0	0
332 GYALECTA FOVEOLARIS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
334 HYPOGYMNIA SUBOBSCURA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
336 LECANORA EPIBRYON	0	0	2.0	0	0	0	0	0	0	0	0	.1	0	0	0
428 LECIDEA RAMULOSA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
339 LECIDEA VERNALIS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
393 LEPTOGIUM SINNUATUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
342 LOPADIUM FECUNDUM	0	0	0	0	0	0	0	0	0	0	0	2.0	0	0	0
343 OCHROLECHIA FRIGIDA	0	0	0	0	0	0	0	0	0	0	0	0	0	.1	0
413 OCHROLECHIA FRIGIDA THELEPHOROIDES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
348 PELTIGERA APHTHOSA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
349 PELTIGERA CANINA S.L.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
353 PELTIGERA SPURIA SOREDIATA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
418 PERTUSARIA CORIACEA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
358 PERTUSARIA DACTYLINA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
384 PERTUSARIA SP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
360 PHYSCONIA MUSCIGENA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
412 PSOROMA HYPNORUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
400 SOLORINA SP.	0	0	0	0	0	0	0	0	0	0	0	0	0	.1	0
369 SPHAEROPHORUS GLOBOSUS	0	0	0	0	0	0	0	0	0	0	0	0	0	.1	0
370 STEREOCAULON ALPINUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
372 THAMNOLIA SUBULIFORMIS	0	0	5.0	.1	0	0	0	0	0	0	0	3.0	0	.1	0
429 TONINIA CUMULATA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
375 XANTHORIA ELEGANS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
403 UNKNOWN CRUSTOSE LICHEN	0	0	15.0	0	0	0	0	.1	0	0	0	0	0	0	0
378 UNKNOWN FRUTICOSE LICHEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
379 NOSTOC COMMUNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
380 NOSTOC SP.	0	0	0	0	0	0	0	.1	0	0	0	0	0	0	0

	1306	1307	1308	1405	1407	1409	1410	1412	1414	1416	1417	1418	1419	1421	1502
VASCULAR PLANTS															
2 ALOPECURUS ALPINUS ALPINUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15.0
3 ANDROSACE CHAMAEJASME LEHMANNIANA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 ANDROSACE SEPTENTRIONALIS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5 ANEMONE PARVIFLORA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 ANEMONE RICHARDSONII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9 ARCTAGROSTIS LATIFOLIA S.L.	0	0	0	0	0	0	0	0	0	0	1.0	1.0	0	0	11.0
10 ARCTOPHILA FULVA	0	20.0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 ARMERIA MARITIMA ARCTICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13 ARTEMISIA ARCTICA ARCTICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14 ARTEMISIA BOREALIS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15 ARTEMISIA GLOMERATA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18 ASTRAGALUS ALPINUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19 ASTRAGALUS UMBELLATUS	0	0	0	0	0	0	0	0	0	4.0	0	0	0	5.0	0
22 BRAYA PURPURASCENS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23 BRAYA SP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24 BROMUS PUMPELLIANUS ARCTICUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25 CALTHA PALUSTRIS ARCTICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27 CARDAMINE DIGITATA	0	0	0	0	0	0	0	.1	0	.1	.1	1.0	0	0	0
26 CARDAMINE PRATENSIS ANGUSTIFOLIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29 CAREX AQUATILIS S.L.	1.0	0	75.0	18.0	15.0	45.0	0	0	0	0	0	0	.1	0	0
30 CAREX ATROFUSCA	0	0	0	0	0	0	0	0	.1	0	0	0	0	0	0
31 CAREX BIGELOWII	0	0	0	0	0	0	8.0	0	0	0	0	24.0	0	0	0
33 CAREX MARINA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35 CAREX MEMBRANACEA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36 CAREX MISANDRA MISANDRA	0	0	0	0	0	0	10.0	4.0	8.0	0	0	0	.1	0	0
37 CAREX RARIFLORA	0	0	1.0	0	10.0	0	1.0	0	35.0	0	0	0	0	0	0
38 CAREX ROTUNDATA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39 CAREX RUPESTRIS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40 CAREX SAXATILIS LAXA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41 CAREX SCIRPOIDEA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42 CAREX SUBSPATHACEA	0	0	0	0	0	0	0	0	.1	0	0	0	0	0	0
44 CAREX VAGINATA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45 CAREX SP.	0	0	0	.1	0	0	0	0	0	0	0	0	1.0	0	0
46 CASSIOPE TETRAGONA TETRAGONA	0	0	0	0	0	0	.1	0	0	45.0	0	0	0	0	0
47 CERASTIUM BEERINGIANUM BEERINGIANUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.0
49 CHRYSANTHEMUM INTEGRIFOLIUM	0	0	0	0	0	0	0	0	0	0	.1	0	0	0	0

Table B5 (cont'd). Raw species data for 1- × 1-m plots.
The units are percentage of cover.

	1306	1307	1308	1405	1407	1409	1410	1412	1414	1416	1417	1418	1419	1421	1502
51 COCHLEARIA OFFICINALIS ARCTICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52 DESCHAMPSIA CAESPITOSA ORIENTALIS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53 DRABA ALPINA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56 DRABA LACTEA	0	0	0	.1	0	0	0	.1	0	0	0	0	.1	0	0
57 DRABA SP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58 DRYAS INTEGRIFOLIA INTEGRIFOLIA	0	0	0	13.0	0	11.0	13.0	60.0	0	20.0	1.0	0	14.0	75.0	1.0
59 DUPONTIA FISHERI S.L.	80.0	0	1.0	0	0	0	0	0	0	0	0	0	0	0	0
61 ELYMUS ARENARIUS MOLLIS VILLOSISSIMUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62 EPILOBIUM LATIFOLIUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63 EQUISETUM ARVENSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64 EQUISETUM SCIRPOIDES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65 EQUISETUM VARIEGATUM	0	0	0	0	0	0	.1	0	.1	0	1.0	0	.1	0	0
66 ERIGERON ERIOCEPHALUS	0	0	0	0	0	0	0	0	0	0	0	0	0	.1	0
399 ERIOPHORUM ANGUSTIFOLIUM S.L.	5.0	0	0	3.0	5.0	6.0	1.0	0	1.0	0	2.0	0	0	0	0
69 ERIOPHORUM RUSSEOLUM	0	0	0	0	2.0	0	0	0	0	0	0	0	0	0	0
70 ERIOPHORUM SCHEUCHZERI SCHEUCHZERI	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72 ERIOPHORUM VAGINATUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73 EUTREMA EDWARDSII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74 FESTUCA BAFFINENSIS	0	0	0	0	0	0	0	0	0	0	0	4.0	0	0	1.0
76 FESTUCA RUBRA	0	0	0	0	0	0	.1	0	0	0	0	0	0	0	7.0
78 GENTIANELLA PROPINQUA PROPINQUA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79 HIEROCHLOE PAUCIFLORA	0	0	1.0	0	0	0	0	0	0	0	0	0	0	0	0
83 JUNCUS BIGLUMIS	0	0	0	0	0	0	0	.1	.1	0	0	0	.1	0	0
84 JUNCUS CASTANEUS CASTANEUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
86 KOBRESIA MYOSUROIDES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
89 LESQUERELLA ARCTICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90 LLOYDIA SEROTINA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.1
91 LUZULA ARCTICA	0	0	0	0	0	0	0	0	0	0	0	0	.1	0	0
92 LUZULA CONFUSA	0	0	0	0	0	0	0	.1	0	0	0	3.0	0	0	0
94 MINUARTIA ARCTICA	0	0	0	0	0	0	0	0	0	0	0	0	.1	0	0
96 MINUARTIA RUBELLA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100 OXYTROPIS BOREALIS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
103 OXYTROPIS NIGRESCENS BRYOPHILA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105 PAPAVER LAPPONICUM OCCIDENTALE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
106 PAPAVER MACOUNII	0	0	0	0	0	1.0	0	1.0	0	.1	0	0	.1	.1	3.0
108 PARRYA NUDICAULIS NUDICAULIS	0	0	0	0	0	0	0	0	0	0	.1	0	0	0	3.0
109 PEDICULARIS CAPITATA	0	0	0	0	0	0	0	1.0	0	3.0	0	14.0	.1	.1	0
110 PEDICULARIS LANATA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
112 PEDICULARIS SUDETICA INTERIOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
381 PEDICULARIS SUDETICA S.L.	0	0	0	0	1.0	0	0	0	1.0	0	0	0	0	0	0
114 PETASITES FRIGIDUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
117 POA ALPIGENA	0	0	0	0	0	0	0	0	0	0	0	10.0	0	0	0
118 POA ARCTICA	0	0	0	0	0	.1	0	0	0	0	0	0	0	0	0
119 POA GLAUCA	0	0	0	0	0	0	0	0	0	0	0	.1	0	0	0
121 POA SP.	0	0	0	0	0	0	0	0	0	2.0	0	0	0	0	0
122 POLEMONIUM BOREALE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
124 POLYGONUM VIVIPARUM	0	0	.1	0	0	0	0	.1	.1	0	.1	5.0	0	0	.1
127 POTENTILLA UNIFLORA	0	0	0	0	0	0	0	0	0	0	0	4.0	0	0	0
129 PUCCINELLIA ANDERSONII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
130 PUCCINELLIA PHRYGANODES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
131 PYROLA GRANDIFLORA	0	0	0	0	0	1.0	0	0	0	0	0	0	0	0	0
13[illegible] RANUNCULUS PALLASII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1[illegible]1 RANUNCULUS PEDATIFIDUS AFFINIS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
137 SAGINA INTERMEDIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13[illegible] SALIX ARCTICA	0	0	4.0	.1	0	0	0	0	.1	0	0	0	0	0	0
140 SALIX LANATA RICHARDSONII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
141 SALIX OVALIFOLIA OVALIFOLIA	7.0	0	9.0	0	0	0	0	0	0	0	0	0	0	0	0
142 SALIX PLANIFOLIA PULCHRA PULCHRA	0	0	0	0	0	3.0	0	0	0	0	0	0	0	0	0
143 SALIX RETICULATA RETICULATA	0	0	0	1.0	0	2.0	2.0	7.0	0	8.0	0	15.0	.1	20.0	0
144 SALIX ROTUNDIFOLIA ROTUNDIFOLIA	0	0	0	0	0	0	0	3.0	0	0	60.0	3.0	0	0	80.0
145 SAUSSUREA ANGUSTIFOLIA	0	0	0	0	0	0	0	2.0	0	0	0	15.0	0	0	0
146 SAXIFRAGA CAESPITOSA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
147 SAXIFRAGA CERNUA	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
148 SAXIFRAGA FOLIOLOSA	0	0	0	0	.1	0	0	0	0	0	0	0	0	0	0
149 SAXIFRAGA HIERACIIFOLIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
150 SAXIFRAGA HIRCULUS PROPINQUA	0	0	1.0	0	0	0	0	0	1.0	0	0	0	0	0	0
151 SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	0	0	0	0	0	0	0	0	0	0	1.0	0	0	0	0
154 SENECIO ATROPURPUREUS FRIGIDUS	0	0	0	0	0	.1	0	.1	0	.1	12.0	.1	0	0	0
156 SENECIO RESEDIFOLIUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
157 SILENE ACAULIS	0	0	0	0	0	0	0	1.0	0	0	0	0	1.0	0	0
159 SILENE WAHLBERGELLA ARCTICA	0	0	0	0	0	0	0	0	.1	0	0	0	0	0	0
160 STELLARIA HUMIFUSA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
161 STELLARIA LAETA	0	0	0	0	0	.1	0	1.0	0	0	0	3.0	1.0	0	0
164 TARAXACUM PHYMATOCARPUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
165 THALICTRUM ALPINUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
168 TRISETUM SPICATUM SPICATUM	0	0	0	0	0	0	0	0	0	0	0	0	0	.1	0
169 UTRICULARIA VULGARIS MACRORHIZA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
172 WILHELMSIA PHYSODES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
901 UNKNOWN MONOCOT	0	0	0	0	0	0	0	0	0	.1	0	0	0	0	0
902 UNKNOWN DICOT	0	0	0	0	0	0	0	0	.1	0	0	0	.1	0	.1
LIVERWORTS															
173 ANEURA PINGUIS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
426 ANASTROPHYLLUM MINUTUM	0	0	0	0	0	0	.1	0	0	0	0	0	0	0	0
175 BLEPHAROSTOMA TRICHOPHYLLUM BREVIRETE	0	0	2.0	0	0	0	0	0	0	0	0	0	0	0	0
397 CALYPOGEIA MUELLERIANA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
460 GYMNOCOLEA INFLATA	0	0	0	.1	0	0	0	0	0	0	0	0	0	0	0
441 HARPANTHUS FLOTOWIANUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
405 LOPHOZIA BINSTEADII	0	0	0	0	0	1.0	0	0	0	0	0	0	0	0	0
433 LOPHOZIA HETEROCOLPA	0	0	0	0	0	0	1.0	0	0	0	0	0	0	0	0
107 LOPHOZIA QUADRILOBA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
186 LOPHOZIA SP.	0	0	0	0	0	.1	.1	0	0	0	0	0	0	0	0
182 PLAGIOCHILA ARCTICA	0	0	0	.1	0	0	0	0	0	0	0	0	0	0	0
184 PTILIDIUM CILIARE	0	0	0	0	0	30.0	4.0	0	0	0	0	0	0	0	0
185 RADULA PROLIFERA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
406 SCAPANIA SIMMONSII	0	0	0	3.0	0	0	0	0	0	0	0	0	0	0	0
168 UNKNOWN LEAFY LIVERWORTS	0	0	1.0	1.0	0	0	.1	0	0	0	1.0	.1	0	0	.1
169 UNKNOWN THALLOID LIVERWORTS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B5 (cont'd).

	1306	1307	1308	1405	1407	1409	1410	1412	1414	1416	1417	1418	1419	1421	1502
MOSSES															
192 AULACOMNIUM ACUMINATUM	0	0	0	1.0	0	0	.1	0	0	0	0	0	0	0	0
193 AULACOMNIUM PALUSTRE	0	0	0	0	0	0	0	0	0	4.0	0	0	0	0	0
194 AULACOMNIUM TURGIDUM	0	0	0	.1	0	0	.1	0	0	0	0	0	0	0	0
448 BRACHYTHECIACEAE	0	0	0	0	0	.1	0	0	.1	0	0	0	0	0	0
132 BRACHYTHECIUM GROENLANDICUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
196 BRACHYTHECIUM TURGIDUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
140 BRYUM ALGOVICUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
199 BRYUM ARCTICUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
205 BRYUM STENOTRICHUM	0	0	0	.1	0	0	.1	0	0	0	0	0	0	0	0
439 BRYUM TORTIFOLIUM	.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
206 BYRUM WRIGHTII	0	0	0	0	0	0	0	0	0	0	0	0	.1	0	0
383 BRYUM SP.	0	0	0	.1	.1	0	2.0	1.0	1.0	2.0	.1	0	.1	1.0	3.0
209 CALLIERGON RICHARDSONII ROBUSTUM	0	0	5.0	0	0	0	0	0	.1	0	0	0	0	0	0
212 CALLIERGON SP.	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.0
213 CAMPYLIUM STELLATUM	20.0	0	10.0	2.0	0	0	0	0	1.0	0	0	0	0	0	0
214 CATOSCOPIUM NIGRITUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
215 CERATODON PURPUREUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
216 CINCLIDIUM ARCTICUM	0	0	0	1.0	0	0	0	0	0	0	0	0	0	0	0
217 CINCLIDIUM LATIFOLIUM	0	0	10.0	0	0	0	0	0	0	0	0	0	0	0	0
411 CINCLIDIUM STYGIUM	0	0	0	.1	0	0	0	0	0	0	0	0	0	0	0
449 CINCLIDIUM SP	0	0	0	0	0	0	.1	0	.1	0	1.0	0	0	0	0
218 CIRRIPHYLLUM CIRROSUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
219 CRATONEURON ARCTICUM	0	0	0	0	0	0	0	0	0	.1	0	0	0	0	0
221 CTENIDIUM MOLLUSCUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
223 CYRTOMNIUM HYMENOPHYLLUM	0	0	0	.1	0	0	0	0	0	0	0	0	0	0	0
227 DICRANUM ANGUSTUM	0	0	0	1.0	0	5.0	1.0	0	0	1.0	0	0	0	0	0
228 DICRANUM ELONGATUM	0	0	0	1.0	0	0	1.0	0	0	0	0	0	0	0	0
390 DICRANUM SP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
229 DIDYMODON ASPERIFOLIUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
230 DISTICHIUM CAPILLACEUM	0	0	20.0	2.0	0	.1	1.0	1.0	0	0	1.0	0	1.0	2.0	0
232 DISTICHIUM INCLINATUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
235 DITRICHUM FLEXICAULE	0	0	0	.1	0	.1	0	1.0	.1	0	0	0	0	0	0
236 DREPANOCLADUS BREVIFOLIUS	0	0	50.0	.1	1.0	0	0	0	40.0	0	0	0	0	0	0
237 DREPANOCLADUS REVOLVENS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
238 DREPANOCLADUS UNCINATUS	0	0	0	0	0	1.0	0	0	0	3.0	5.0	0	0	0	0
239 DREPANOCLADUS SP.	0	0	0	0	0	0	.1	0	0	0	0	0	0	0	0
240 ENCALYPTA ALPINA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
241 ENCALYPTA PROCERA	0	0	0	0	0	0	0	0	[illegible]	0	0	0	0	0	0
244 ENCALYPTA SP.	0	0	0	.1	0	0	.1	1.0	0	0	.1	0	0	0	.1
246 FISSIDENS OSMUNDOIDES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
450 FISSIDENS SP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
247 FUNARIA ARCTICA	0	0	0	0	0	0	0	0	0	0	0	.1	0	0	0
250 HYLOCOMIUM SPLENDENS OBTUSIFOLIUM	0	0	0	1.0	0	20.0	0	0	0	0	0	0	0	0	0
251 HYPNUM BAMBERGERI	0	0	0	.1	0	0	0	0	0	0	0	0	0	0	0
252 HYPNUM CUPRESSIFORME	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
253 HYPNUM PROCERRIMUM	0	0	0	1.0	0	0	0	0	0	1.0	0	0	0	0	0
254 HYPNUM REVOLUTUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
256 HYPNUM SP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
257 LEPTOBRYUM PYRIFORME	0	0	0	0	0	0	0	0	0	0	0	.1	0	0	0
258 MEESIA TRIQUETRA	0	0	0	0	0	0	0	0	.1	0	0	0	0	0	0
259 MEESIA ULIGINOSA	0	0	0	1.0	0	0	0	0	0	0	0	0	0	0	0
411 MNIUM ANDREWSIANUM	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
260 MNIUM BLYTTII	0	0	0	0	0	0	0	0	.1	0	0	.1	0	0	0
451 PLAGIOMNIUM ELLIPTICUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
262 MYURELLA JULACEA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
264 ONCOPHORUS WAHLENBERGII	0	0	0	.1	0	0	5.0	0	0	0	0	0	0	0	0
265 ORTHOTHECIUM CHRYSEUM	0	0	0	1.0	0	.1	0	0	0	0	0	0	0	0	0
268 PHILONOTIS FONTANA PUMILA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
410 PLAGIOPUS OEDERIANA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
272 POGONATUM ALPINUM	0	0	0	0	0	2.0	3.0	0	0	0	0	.1	0	0	0
446 POLYTRICHACEAE	0	0	0	0	0	0	0	0	0	0	0	0	.1	0	0
275 POHLIA NUTANS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
404 POHLIA SP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
276 RHACOMITRIUM LANUGINOSUM	0	0	0	0	0	0	0	0	0	0	0	0	1.0	0	1.0
277 RHYTIDIUM RUGOSUM	0	0	0	1.0	0	1.0	1.0	.1	0	0	0	0	1.0	5.0	0
279 SCORPIDIUM SCORPIOIDES	0	0	0	0	75.0	0	0	0	0	0	0	0	0	0	0
280 SCORPIDIUM TURGESCENS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
282 SPLACHNUM VASCULOSUM	0	0	0	0	0	0	0	0	.1	0	0	0	0	0	0
283 STEGONIA LATIFOLIA PILIFERA	0	0	0	0	0	0	0	0	0	0	0	.1	0	0	0
285 TETRAPLODON MNIOIDES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
287 THUIDIUM ABIETINUM	0	0	0	0	0	0	0	0	0	1.0	0	0	0	5.0	3.0
288 TIMMIA AUSTRIACA	0	0	0	0	0	0	0	0	0	.1	0	0	0	3.0	1.0
289 TIMMIA MEGAPOLITANA BAVARICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
290 TIMMIA NORVEGICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
291 TOMENTHYPNUM NITENS	0	0	0	12.0	0	5.0	1.0	0	0	0	80.0	0	3.0	2.0	0
292 TORTELLA ARCTICA	0	0	0	0	0	.1	0	0	0	0	0	0	0	0	0
296 TORTULA RURALIS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15.0
298 VOITIA HYPERBOREA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
903 UNKNOWN MOSS	1.0	0	2.0	4.0	1.0	2.0	3.0	0	1.0	2.0	1.0	.1	0	1.0	2.0
LICHENS															
299 ALECTORIA NIGRICANS	0	0	0	.1	0	0	1.0	0	0	0	0	0	1.0	0	0
300 ALECTORIA OCHROLEUCA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
307 CALOPLACA SP.	0	0	0	.1	0	0	0	0	0	.1	0	0	0	0	0
310 CETRARIA CUCULLATA	0	0	0	1.0	0	.1	2.0	1.0	0	5.0	0	0	1.0	5.0	0
311 CETRARIA DELISEI	0	0	0	0	0	0	0	0	0	0	1.0	0	0	0	0
312 CETRARIA ISLANDICA	0	0	0	1.0	0	.1	1.0	1.0	0	3.0	.1	0	1.0	2.0	.1
314 CETRARIA NIVALIS	0	0	0	.1	0	0	.1	1.0	0	1.0	.1	0	1.0	5.0	0
315 CETRARIA RICHARDSONII	0	0	0	0	0	.1	0	0	0	3.0	0	0	0	10.0	0
316 CETRARIA TILESII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
385 CLADONIA GRACILIS	0	0	0	.1	0	.1	.1	0	0	0	0	0	0	0	0
418 CLADONIA LEPIDOTA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
427 CLADONIA PHYLLOPHORA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
319 CLADONIA POCILLUM	0	0	0	0	0	.1	.1	.1	0	1.0	0	0	1.0	0	0
320 CLADONIA SQUAMOSA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
322 CLADONIA SP.	0	0	0	1.0	0	.1	0	0	0	0	0	.1	0	0	0
327 CORNICULARIA DIVERGENS	0	0	0	0	0	0	0	1.0	0	0	0	0	0	0	0

Table B5 (cont'd). Raw species data for 1- × 1-m plots.
The units are percentage of cover.

	1306	1307	1308	1405	1407	1409	1410	1412	1414	1416	1417	1418	1419	1421	1502
328 DACTYLINA ARCTICA	0	0	0	0	0	.1	0	.1	0	1.0	0	.1	1.0	2.0	0
329 DACTYLINA RAMULOSA	0	0	0	1.0	0	0	2.0	0	0	0	.1	0	0	0	0
330 EVERNIA PERFRAGILIS	0	0	0	0	0	0	0	.1	0	0	0	.1	0	0	0
331 FULGENSIA BRACTEATA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
332 GYALECTA FOVEOLARIS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
334 HYPOGYMNIA SUBOBSCURA	0	0	0	0	0	0	0	1.0	0	0	0	0	0	0	0
336 LECANORA EPIBRYON	0	0	0	.1	0	0	0	3.0	0	7.0	0	0	1.0	0	.1
428 LECIDEA RAMULOSA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
339 LECIDEA VERNALIS	0	0	0	0	0	0	0	.1	0	0	0	0	0	0	0
395 LEPTOGIUM SINUATUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
342 LOPADIUM FECUNDUM	0	0	0	0	0	0	3.0	1.0	0	0	0	0	0	0	.1
345 OCHROLECHIA FRIGIDA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
413 OCHROLECHIA FRIGIDA THELEPHOROIDES	0	0	0	3.0	0	0	17.0	1.0	0	0	0	0	1.0	0	0
348 PELTIGERA APHTHOSA	0	0	0	0	0	.1	0	0	0	5.0	0	.1	0	0	0
349 PELTIGERA CANINA S.L.	0	0	0	0	0	0	0	0	0	.1	0	.1	0	0	0
353 PELTIGERA SPURIA SOREDIATA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
418 PERTUSARIA CORIACEA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
358 PERTUSARIA DACTYLINA	0	0	0	0	0	.1	0	0	0	0	0	0	0	0	0
384 PERTUSARIA SP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
366 PHYSCONIA MUSCIGENA	0	0	0	0	0	0	0	.1	0	1.0	0	0	0	0	0
412 PSOROMA HYPNORUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
400 SOLORINA SP	0	0	0	.1	0	0	0	0	0	0	0	0	0	0	0
369 SPHAEROPHORUS GLOBOSUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
370 STEREOCAULON ALPINUM	0	0	0	.1	0	0	0	0	0	0	1.0	0	0	0	0
372 THAMNOLIA SUBULIFORMIS	0	0	0	1.0	0	1.0	2.0	4.0	0	.1	0	.1	3.0	1.0	0
429 TONINIA CUMULATA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
375 XANTHORIA ELEGANS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
403 UNKNOWN CRUSTOSE LICHEN	0	0	0	0	0	0	0	3.0	0	.1	0	0	0	1.0	0
378 UNKNOWN FRUTICOSE LICHEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
379 NOSTOC COMMUNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
380 NOSTOC SP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	1506	1509	1513	1514	1515	1517	1518	1520
VASCULAR PLANTS								
2 ALOPECURUS ALPINUS ALPINUS	0	0	0	0	0	0	0	0
3 ANDROSACE CHAMAEJASME LEHMANNIANA	0	0	0	0	0	0	0	0
4 ANDROSACE SEPTENTRIONALIS	0	0	0	0	0	0	0	0
5 ANEMONE PARVIFLORA	0	1.0	0	0	0	0	0	0
6 ANEMONE RICHARDSONII	0	0	0	0	0	0	0	0
9 ARCTAGROSTIS LATIFOLIA S.L.	0	0	0	0	0	0	0	0
10 ARCTOPHILA FULVA	0	0	0	0	0	0	0	0
12 ARMERIA MARITIMA ARCTICA	0	0	0	0	0	0	0	0
13 ARTEMISIA ARCTICA ARCTICA	0	0	0	0	0	0	0	0
14 ARTEMISIA BOREALIS	0	0	0	0	0	0	0	0
15 ARTEMISIA GLOMERATA	0	0	0	0	0	0	0	0
18 ASTRAGALUS ALPINUS	0	2.0	0	0	0	0	0	0
19 ASTRAGULUS UMBELLATUS	0	1.0	0	0	0	0	0	0
22 BRAYA PURPURASCENS	0	0	0	0	0	0	0	0
23 BRAYA SP.	0	0	0	0	0	0	0	0
24 BROMUS PUMPELLIANUS ARCTICUS	0	0	0	0	0	0	0	0
25 CALTHA PALUSTRIS ARCTICA	0	0	0	0	0	0	0	0
27 CARDAMINE DIGITATA	.1	.1	0	0	0	0	0	0
28 CARDAMINE PRATENSIS ANGUSTIFOLIA	0	0	0	0	0	0	0	0
29 CAREX AQUATILIS S.L.	0	0	0	0	0	60.0	20.0	0
30 CAREX ATROFUSCA	0	0	0	0	0	0	0	0
31 CAREX BIGELOWII	0	0	0	0	0	0	0	0
33 CAREX MARINA	0	0	0	0	0	0	0	0
35 CAREX MEMBRANACEA	.1	0	0	0	25.0	0	0	0
36 CAREX MISANDRA MISANDRA	0	0	0	0	0	0	0	0
37 CAREX RARIFLORA	0	0	0	0	0	0	0	0
38 CAREX ROTUNDATA	0	0	0	0	0	0	0	0
39 CAREX RUPESTRIS	0	0	0	0	0	0	0	0
40 CAREX SAXATILIS LAXA	0	0	0	0	0	0	0	0
41 CAREX SCIRPOIDEA	0	5.0	0	0	0	0	0	0
42 CAREX SUBSPATHACEA	0	0	0	0	0	0	0	0
44 CAREX VAGINATA	0	0	0	0	0	0	0	0
45 CAREX SP	0	0	0	0	0	0	0	0
46 CASSIOPE TETRAGONA TETRAGONA	0	45.0	0	0	0	0	0	0
47 CERASTIUM BEERINGIANUM BEERINGIANUM	0	0	0	0	0	0	0	0
49 CHRYSANTHEMUM INTEGRIFOLIUM	0	.1	0	0	.1	0	0	0
51 COCHLEARIA OFFICINALIS ARCTICA	0	0	0	0	0	0	0	0
52 DESCHAMPSIA CAESPITOSA ORIENTALIS	0	0	0	0	0	0	0	0
53 DRABA ALPINA	0	0	0	0	0	0	0	.1
56 DRABA LACTEA	0	0	0	0	0	0	0	0
57 DRABA SP	0	0	0	0	0	0	0	0
58 DRYAS INTEGRIFOLIA INTEGRIFOLIA	30.0	32.0	80.0	40.0	70.0	0	0	30.0
59 DUPONTIA FISHERI S.L.	0	0	0	0	0	0	0	0
61 ELYMUS ARENARIUS MOLLIS VILLOSISSIMUS	0	0	0	0	0	0	0	0
62 EPILOBIUM LATIFOLIUM	0	0	0	0	0	0	0	0
63 EQUISETUM ARVENSE	0	.1	0	0	0	0	0	0
64 EQUISETUM SCIRPOIDES	0	0	0	0	0	0	0	0
65 EQUISETUM VARIEGATUM	.1	.1	0	1.0	.1	0	0	0
66 ERIGERON ERIOCEPHALUS	0	0	0	0	0	0	0	0
399 ERIOPHORUM ANGUSTIFOLIUM S.L.	15.0	0	0	35.0	10.0	2.0	2.0	0
69 ERIOPHORUM RUSSEOLUM	0	0	0	0	0	0	1.0	0
70 ERIOPHORUM SCHEUCHZERI SCHEUCHZERI	0	0	0	0	0	0	0	0
72 ERIOPHORUM VAGINATUM	0	0	0	0	0	0	0	0
73 EUTREMA EDWARDSII	0	0	0	0	0	0	0	0
74 FESTUCA BAFFINENSIS	0	0	0	0	0	0	0	0
76 FESTUCA RUBRA	0	0	0	0	0	0	0	0
78 GENTIANELLA PROPINQUA PROPINQUA	0	0	0	0	0	0	0	0
79 HIEROCHLOE PAUCIFLORA	0	0	0	0	0	0	0	0
83 JUNCUS BIGLUMIS	0	0	0	0	0	0	0	0
84 JUNCUS CASTANEUS CASTANEUS	0	0	0	0	0	0	0	0
86 KOBRESIA MYOSUROIDES	0	.1	0	0	0	0	0	0
89 LESQUERELLA ARCTICA	0	0	0	0	0	0	0	0
90 LLOYDIA SEROTINA	0	2.0	0	0	0	0	0	.1
91 LUZULA ARCTICA	0	0	0	0	0	0	0	0
92 LUZULA CONFUSA	0	0	0	0	0	0	0	0
94 MINUARTIA ARCTICA	0	0	1	0	0	0	0	0

Table B5 (cont'd).

	1506	1509	1513	1514	1515	1517	1518	1520
96 MINUARTIA RUBELLA	0	0	0	0	0	0	0	0
100 OXYTROPIS BOREALIS	0	0	0	0	0	0	0	0
103 OXYTROPIS NIGRESCENS BRYOPHILA	0	0	.1	0	0	0	0	10.0
105 PAPAVER LAPPONICUM OCCIDENTALE	0	0	0	0	0	0	0	0
106 PAPAVER MACOUNII	.1	0	1	0	.1	0	0	0
109 PARRYA NUDICAULIS NUDICAULIS	0	0	1.0	0	0	0	0	0
109 PEDICULARIS CAPITATA	0	0	0	0	.1	0	0	0
110 PEDICULARIS LANATA	3.0	.1	0	0	.1	0	0	.1
112 PEDICULARIS SUDETICA INTERIOR	0	0	0	0	0	0	0	0
381 PEDICULARIS SUDETICA S.L	0	0	0	0	0	1.0	0	0
114 PETASITES FRIGIDUS	0	0	0	0	0	0	0	0
117 POA ALPIGENA	0	0	0	0	0	0	0	0
118 POA ARCTICA	0	0	0	0	0	0	0	0
119 POA GLAUCA	0	0	0	0	0	0	0	0
121 POA SP.	0	0	0	0	0	0	0	0
122 POLEMONIUM BOREALE	0	0	0	0	0	0	0	0
124 POLYGONUM VIVIPARUM	.1	.1	0	.1	0	0	0	0
127 POTENTILLA UNIFLORA	0	0	0	0	0	0	0	0
129 PUCCINELLIA ANDERSONII	0	0	0	0	0	0	0	0
130 PUCCINELLIA PHRYGANODES	0	0	0	0	0	0	0	0
131 PYROLA GRANDIFLORA	0	0	0	0	0	0	0	0
135 RANUNCULUS PALLASII	0	0	0	0	0	0	0	0
134 RANUNCULUS PEDATIFIDUS AFFINIS	0	0	0	0	0	0	0	0
137 SAGINA INTERMEDIA	0	0	0	0	0	0	0	0
189 SALIX ARCTICA	.1	0	0	.1	2.0	0	0	0
140 SALIX LANATA RICHARDSONII	0	0	0	0	0	0	0	0
141 SALIX OVALIFOLIA OVALIFOLIA	0	0	0	1.0	0	0	0	0
142 SALIX PLANIFOLIA PULCHRA PULCHRA	0	0	0	0	0	0	0	0
143 SALIX RETICULATA RETICULATA	0	6.0	0	12.0	0	0	0	.1
144 SALIX ROTUNDIFOLIA ROTUNDIFOLIA	0	1.0	.1	.1	.1	0	0	.1
145 SAUSSUREA ANGUSTIFOLIA	0	.1	0	0	0	0	0	0
146 SAXIFRAGA CAESPITOSA	0	0	0	0	0	0	0	0
147 SAXIFRAGA CERNUA	0	0	0	0	0	0	0	0
148 SAXIFRAGA FOLIOLOSA	0	0	0	0	0	0	0	0
149 SAXIFRAGA HIERACIFOLIA	0	0	0	0	0	0	0	0
150 SAXIFRAGA HIRCULUS PROPINQUA	0	0	0	0	0	0	0	0
151 SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	12.0	0	1.0	.1	2.0	0	0	3.0
154 SENECIO ATROPURPUREUS FRIGIDUS	.1	1.0	0	.1	.1	0	0	0
156 SENECIO RESEDIFOLIUS	0	0	0	0	0	0	0	0
157 SILENE ACAULIS	0	4.0	0	0	0	0	0	0
159 SILENE WAHLBERGELLA ARCTICA	0	0	0	0	0	0	0	0
160 STELLARIA HUMIFUSA	0	0	0	0	0	0	0	0
161 STELLARIA LAETA	0	0	0	0	0	0	0	0
164 TARAXACUM PHYMATOCARPUM	0	0	0	0	0	0	0	0
165 THALICTRUM ALPINUM	0	0	0	0	0	0	0	0
168 TRISETUM SPICATUM SPICATUM	0	0	0	0	0	0	0	0
169 UTRICULARIA VULGARIS MACRORHIZA	0	0	0	0	0	0	0	0
172 WILHELMSIA PHYSODES	0	0	0	0	0	0	0	0
901 UNKNOWN MONOCOT	0	0	0	0	0	0	0	0
902 UNKNOWN DICOT	0	.1	0	0	0	0	0	0
LIVERWORTS								
173 ANEURA PINGUIS	0	0	0	0	0	0	0	0
426 ANASTROPHYLLUM MINUTUM	0	0	0	0	0	0	0	0
175 BLEPHAROSTOMA TRICHOPHYLLUM BREVIRETE	0	0	0	0	0	0	0	0
397 CALYPOGEIA MUELLERIANA	0	0	0	0	0	0	0	0
160 GYMNOCOLEA INFLATA	0	0	0	0	0	0	0	0
411 HARPANTHUS FLOTOWIANUS	0	0	0	0	0	0	0	0
405 LOPHOZIA BINSTEADII	0	0	0	0	0	0	0	0
433 LOPHOZIA HETEROCOLPA	0	0	0	0	0	0	0	0
407 LOPHOZIA QUADRILOBA	0	0	0	0	0	0	0	0
436 LOPHOZIA SP	0	0	0	0	0	0	0	0
182 PLAGIOCHILA ARCTICA	0	.1	.1	0	0	0	0	0
184 PTILIDIUM CILIARE	0	0	0	0	0	0	0	0
185 RADULA PROLIFERA	0	0	0	0	0	0	0	0
166 SCAPANIA SIMMONSII	0	0	0	0	0	0	0	0
168 UNKNOWN LEAFY LIVERWORTS	0	0	.1	0	0	0	0	0
169 UNKNOWN THALLOID LIVERWORTS	0	0	0	0	0	0	0	0
MOSSES								
192 AULACOMNIUM ACUMINATUM	0	0	0	0	0	0	0	0
193 AULACOMNIUM PALUSTRE	0	0	0	0	0	0	0	0
194 AULACOMNIUM TURGIDUM	0	0	0	0	0	0	0	0
448 BRACHYTHECIACEAE	0	0	0	0	0	0	0	0
432 BRACHYTHECIUM GROENLANDICUM	0	0	0	0	0	0	0	0
196 BRACHYTHECIUM TURGIDUM	0	0	0	0	0	0	0	0
440 BRYUM ALGOVICUM	0	0	0	0	0	0	0	0
199 BRYUM ARCTICUM	0	0	0	0	0	0	0	0
205 BRYUM STENOTRICHUM	0	0	0	0	0	0	0	0
139 BRYUM TORTIFOLIUM	0	0	0	0	0	0	0	0
206 BYRUM WRIGHTII	0	0	0	0	0	0	0	0
383 BRYUM SP	.1	0	0	0	0	0	0	1
209 CALLIERGON RICHARDSONII ROBUSTUM	0	0	0	1.0	0	0	0	0
212 CALLIERGON SP.	0	0	0	0	0	1	0	0
213 CAMPYLIUM STELLATUM	0	0	0	0	0	0	0	0
214 CATOSCOPIUM NIGRITUM	0	0	0	1	0	0	0	0
215 CERATODON PURPUREUS	0	0	0	0	0	0	0	0
216 CINCLIDIUM ARCTICUM	0	0	0	0	0	0	0	0
217 CINCLIDIUM LATIFOLIUM	0	0	0	0	0	0	0	0
111 CINCLIDIUM STYGIUM	0	0	0	0	0	0	0	0
149 CINCLIDIUM SP	0	0	0	1	0	0	0	0
218 CIRRIPHYLLUM CIRROSUM	0	0	0	0	0	0	0	0
219 CRATONEURON ARCTICUM	0	0	0	0	0	0	0	0
221 CTENIDIUM MOLLUSCUM	0	0	0	0	0	0	0	0
223 CYRTOMNIUM HYMENOPHYLLUM	0	0	0	0	0	0	0	0
227 DICRANUM ANGUSTUM	0	0	0	0	0	0	0	0
228 DICRANUM ELONGATUM	0	0	0	0	0	0	0	0
390 DICRANUM SP.	0	0	0	0	0	0	0	0
229 DIDYMODON ASPERIFOLIUS	0	0	0	0	0	0	0	0
230 DISTICHIUM CAPILLACEUM	.1	0	0	1.0	1.0	0	0	0
232 DISTICHIUM INCLINATUM	0	0	0	0	0	0	0	0

Table B5 (cont'd). Raw species data for 1- × 1-m plots. The units are percentage of cover.

	1506	1509	1513	1514	1515	1517	1518	1520
233 DITRICHUM FLEXICAULE	12.0	5.0	4.0	6.0	20.0	0	0	.1
236 DREPANOCLADUS BREVIFOLIUS	0	0	0	20.0	0	0	0	0
237 DREPANOCLADUS REVOLVENS	0	0	0	0	0	0	0	0
238 DREPANOCLADUS UNCINATUS	15.0	1.0	1.0	3.0	0	0	0	.1
239 DREPANOCLADUS SP.	0	0	0	0	0	0	0	0
240 ENCALYPTA ALPINA	0	0	0	0	0	0	0	0
241 ENCALYPTA PROCERA	0	0	0	0	0	0	0	0
244 ENCALYPTA SP.	1	0	0	.1	0	0	0	0
246 FISSIDENS OSMUNDOIDES	0	0	0	0	0	0	0	0
450 FISSIDENS SP.	0	0	0	0	0	0	0	0
247 FUNARIA ARCTICA	0	0	0	0	0	0	0	0
250 HYLOCOMIUM SPLENDENS OBTUSIFOLIUM	0	0	0	0	0	0	0	0
251 HYPNUM BAMBERGERI	1.0	0	.1	0	1.0	0	0	0
252 HYPNUM CUPRESSIFORME	0	0	0	0	0	0	0	2.0
253 HYPNUM PROCERRIMUM	4.0	0	1.0	0	1.0	0	0	0
254 HYPNUM REVOLUTUM	0	0	0	0	0	0	0	0
256 HYPNUM SP.	0	0	0	0	0	0	0	0
257 LEPTOBRYUM PYRIFORME	0	0	0	0	0	0	0	0
258 MEESIA TRIQUETRA	0	0	0	0	0	.1	0	0
259 MEESIA ULIGINOSA	0	0	0	0	.1	0	0	0
444 MNIUM ANDREWSIANUM	0	0	0	0	0	0	0	0
260 MNIUM BLYTTII	0	0	0	0	0	0	0	0
131 PLAGIOMNIUM ELLIPTICUM	0	0	0	0	0	0	0	0
262 MYURELLA JULACEA	0	0	0	0	0	0	0	0
264 ONCOPHORUS WAHLENBERGII	0	0	0	0	0	0	0	0
265 ORTHOTHECIUM CHRYSEUM	0	0	0	0	0	0	0	0
268 PHILONOTIS FONTANA PUMILA	0	0	0	0	0	0	0	0
410 PLAGIOPUS OEDERIANA	0	0	0	0	0	0	0	0
272 POGONATUM ALPINUM	0	0	0	0	0	0	0	0
446 POLYTRICHACEAE	0	0	0	0	0	0	0	0
275 POHLIA NUTANS	0	0	0	0	0	0	0	0
104 POHLIA SP.	0	0	0	0	0	0	0	0
276 RHACOMITRIUM LANUGINOSUM	0	0	0	0	0	0	0	0
278 RHYTIDIUM RUGOSUM	0	0	0	0	0	0	0	0
279 SCORPIDIUM SCORPIOIDES	0	0	0	0	0	60.0	0	0
280 SCORPIDIUM TURGESCENS	0	0	0	0	0	0	0	0
282 SPLACHNUM VASCULOSUM	0	0	0	0	0	0	0	0
283 STEGONIA LATIFOLIA PILIFERA	0	0	0	0	0	0	0	0
285 TETRAPLODON MNIOIDES	0	0	0	0	0	0	0	0
287 THUIDIUM ABIETINUM	0	1.0	.1	0	0	0	0	3.0
288 TIMMIA AUSTRIACA	0	0	0	0	0	0	0	0
289 TIMMIA MEGAPOLITANA BAVARICA	0	0	0	0	0	0	0	0
290 TIMMIA NORVEGICA	0	0	0	0	0	0	0	0
291 TOMENTHYPNUM NITENS	7.0	1.0	0	5.0	40.0	0	0	0
292 TORTELLA ARCTICA	0	0	0	0	0	0	0	0
296 TORTULA RURALIS	0	0	0	0	0	0	0	.1
298 VOITIA HYPERBOREA	0	0	0	0	0	0	0	0
905 UNKNOWN MOSS	.1	1.0	0	1.0	0	0	0	.1
LICHENS								
299 ALECTORIA NIGRICANS	0	0	0	0	0	0	0	0
300 ALECTORIA OCHROLEUCA	0	0	0	0	0	0	0	0
307 CALOPLACA SP.	0	0	0	0	0	0	0	0
310 CETRARIA CUCULLATA	.1	0	1.0	0	.1	0	0	.1
311 CETRARIA DELISEI	0	0	0	0	0	0	0	0
312 CETRARIA ISLANDICA	1.0	0	0	0	1.0	0	0	.1
314 CETRARIA NIVALIS	0	0	0	0	0	0	0	.1
315 CETRARIA RICHARDSONII	0	.1	0	0	0	0	0	0
316 CETRARIA TILESII	0	0	0	0	0	0	0	0
385 CLADONIA GRACILIS	0	0	0	0	0	0	0	0
318 CLADONIA LEPIDOTA	0	0	0	0	0	0	0	0
427 CLADONIA PHYLLOPHORA	0	0	0	0	0	0	0	0
319 CLADONIA POCILLUM	0	0	0	0	0	0	0	0
320 CLADONIA SQUAMOSA	0	0	0	0	0	0	0	0
322 CLADONIA SP.	0	0	0	0	0	0	0	0
327 CORNICULARIA DIVERGENS	0	0	0	0	0	0	0	0
328 DACTYLINA ARCTICA	0	0	0	.1	5.0	0	0	.1
329 DACTYLINA RAMULOSA	1.0	0	0	0	0	0	0	0
330 EVERNIA PERFRAGILIS	0	0	0	0	0	0	0	.1
331 FULGENSIA BRACTEATA	0	0	0	0	0	0	0	.1
332 GYALECTA FOVEOLARIS	0	0	0	0	0	0	0	0
334 HYPOGYMNIA SUBOBSCURA	0	0	0	0	0	0	0	.1
336 LECANORA EPIBRYON	.1	0	8.0	0	.1	0	0	7.0
128 LECIDEA RAMULOSA	0	0	0	0	0	0	0	0
339 LECIDEA VERNALIS	0	0	0	0	0	0	0	0
393 LEPTOGIUM SINUATUM	0	0	0	0	0	0	0	0
342 LOPADIUM FECUNDUM	10.0	0	0	0	0	0	0	12.0
343 OCHROLECHIA FRIGIDA	0	0	0	0	0	0	0	0
413 OCHROLECHIA FRIGIDA THELEPHOROIDES	0	0	0	0	0	0	0	0
348 PELTIGERA APHTHOSA	0	0	0	0	0	0	0	0
349 PELTIGERA CANINA S.L.	0	1.0	0	0	.1	0	0	.1
353 PELTIGERA SPURIA SOREDIATA	0	0	0	0	0	0	0	0
418 PERTUSARIA CORIACEA	0	0	1.0	0	0	0	0	3.0
358 PERTUSARIA DACTYLINA	0	0	0	0	0	0	0	0
384 PERTUSARIA SP.	0	0	0	0	0	0	0	.1
360 PHYSCONIA MUSCIGENA	0	0	0	0	0	0	0	.1
412 PSOROMA HYPNORUM	0	0	0	0	0	0	0	0
400 SOLORINA SP.	2.0	.1	0	0	0	0	0	0
369 SPHAEROPHORUS GLOBOSUS	0	0	0	0	0	0	0	0
370 STEREOCAULON ALPINUM	0	0	0	0	0	0	0	.1
372 THAMNOLIA SUBULIFORMIS	6.0	0	2.0	1.0	7.0	0	0	2.0
429 TONINIA CUMULATA	0	0	0	0	0	0	0	0
375 XANTHORIA ELEGANS	0	0	0	0	0	0	0	.1
403 UNKNOWN CRUSTOSE LICHEN	.1	0	1.0	0	0	0	0	1.0
378 UNKNOWN FRUTICOSE LICHEN	0	0	0	0	0	0	0	0
379 NOSTOC COMMUNE	0	0	0	0	0	0	0	0
380 NOSTOC SP	0	0	0	0	0	0	0	0

Table B6. Raw species data for larger plots.
The units are percentage of cover.

	1202	1422	1521
VASCULAR PLANTS			
2 ALOPECURUS ALPINUS ALPINUS	.1	0	.1
3 ANDROSACE CHAMAEJASME LEHMANNIANA	1.0	.1	0
4 ANDROSACE SEPTENTRIONALIS	0	.1	0
5 ANEMONE PARVIFLORA	0	0	0
6 ANEMONE RICHARDSONII	0	0	0
9 ARCTAGROSTIS LATIFOLIA S.L.	0	0	.1
10 ARCTOPHILA FULVA	0	0	0
12 ARMERIA MARITIMA ARCTICA	.1	0	0
13 ARTEMISIA ARCTICA ARCTICA	0	0	.1
14 ARTEMISIA BOREALIS	2.0	0	2.0
15 ARTEMISIA GLOMERATA	.1	0	.1
18 ASTRAGALUS ALPINUS	0	1.0	.1
19 ASTRAGULUS UMBELLATUS	0	0	0
22 BRAYA PURPURASCENS	0	0	1.0
23 BRAYA SP.	0	0	0
24 BROMUS PUMPELLIANUS ARCTICUS	0	1.0	0
25 CALTHA PALUSTRIS ARCTICA	0	0	0
27 CARDAMINE DIGITATA	0	0	0
28 CARDAMINE PRATENSIS ANGUSTIFOLIA	0	0	0
29 CAREX AQUATILIS S.L.	0	0	.1
30 CAREX ATROFUSCA	0	0	0
31 CAREX BIGELOWII	0	0	0
33 CAREX MARINA	0	0	0
35 CAREX MEMBRANACEA	0	0	0
36 CAREX MISANDRA MISANDRA	0	0	0
37 CAREX RARIFLORA	0	0	0
38 CAREX ROTUNDATA	0	0	0
39 CAREX RUPESTRIS	0	0	0
40 CAREX SAXATILIS LAXA	0	0	0
41 CAREX SCIRPOIDEA	0	0	0
42 CAREX SUBSPATHACEA	0	0	0
44 CAREX VAGINATA	0	0	0
45 CAREX SP.	0	0	0
46 CASSIOPE TETRAGONA TETRAGONA	0	0	0
47 CERASTIUM BEERINGIANUM BEERINGIANUM	0	3.0	0
49 CHRYSANTHEMUM INTEGRIFOLIUM	0	0	0
51 COCHLEARIA OFFICINALIS ARCTICA	0	0	0
52 DESCHAMPSIA CAESPITOSA ORIENTALIS	0	0	0
53 DRABA ALPINA	.1	0	0
56 DRABA LACTEA	0	0	0
57 DRABA SP.	0	.1	0
58 DRYAS INTEGRIFOLIA INTEGRIFOLIA	1.0	45.0	0
59 DUPONTIA FISHERI S.L.	1.0	0	.1
61 ELYMUS ARENARIUS MOLLIS VILLOSISSIMUS	0	0	2.0
62 EPILOBIUM LATIFOLIUM	0	0	5.0
63 EQUISETUM ARVENSE	0	0	.1
64 EQUISETUM SCIRPOIDES	0	0	0
65 EQUISETUM VARIEGATUM	0	0	0
66 ERIGERON ERIOCEPHALUS	0	0	0
399 ERIOPHORUM ANGUSTIFOLIUM S.L.	0	0	0
69 ERIOPHORUM RUSSEOLUM	0	0	0
70 ERIOPHORUM SCHEUCHZERI SCHEUCHZERI	0	0	0
72 ERIOPHORUM VAGINATUM	0	0	0
73 EUTREMA EDWARDSII	0	0	0
74 FESTUCA BAFFINENSIS	0	0	0
76 FESTUCA RUBRA	0	0	0
78 GENTIANELLA PROPINQUA PROPINQUA	0	0	0
79 HIEROCHLOE PAUCIFLORA	0	0	0
83 JUNCUS BIGLUMIS	0	0	0
84 JUNCUS CASTANEUS CASTANEUS	0	0	0
86 KOBRESIA MYOSUROIDES	0	0	0
89 LESQUERELLA ARCTICA	0	0	0
90 LLOYDIA SEROTINA	0	0	0
91 LUZULA ARCTICA	0	0	0
92 LUZULA CONFUSA	0	0	0
94 MINUARTIA ARCTICA	0	0	0
96 MINUARTIA RUBELLA	0	0	0
100 OXYTROPIS BOREALIS	0	0	0
103 OXYTROPIS NIGRESCENS BRYOPHILA	0	0	0
105 PAPAVER LAPPONICUM OCCIDENTALE	0	.1	.1
106 PAPAVER MACOUNII	0	0	0
108 PARRYA NUDICAULIS NUDICAULIS	.1	0	.1
109 PEDICULARIS CAPITATA	0	0	0
110 PEDICULARIS LANATA	.1	0	0
112 PEDICULARIS SUDETICA INTERIOR	0	0	0
381 PEDICULARIS SUDETICA S.L	0	0	0
114 PETASITES FRIGIDUS	0	0	0
117 POA ALPIGENA	0	30.0	0
118 POA ARCTICA	0	0	0
119 POA GLAUCA	0	0	0
121 POA SP.	0	0	1
122 POLEMONIUM BOREALE	0	1.0	1
124 POLYGONUM VIVIPARUM	2.0	0	0
127 POTENTILLA UNIFLORA	.1	15.0	0
129 PUCCINELLIA ANDERSONII	0	0	0
130 PUCCINELLIA PHRYGANODES	0	0	0
131 PYROLA GRANDIFLORA	0	0	0
133 RANUNCULUS PALLASII	0	0	0
134 RANUNCULUS PEDATIFIDUS AFFINIS	0	2.0	0
137 SAGINA INTERMEDIA	0	0	0
139 SALIX ARCTICA	0	0	0
140 SALIX LANATA RICHARDSONII	0	0	0
141 SALIX OVALIFOLIA OVALIFOLIA	25.0	0	1
142 SALIX PLANIFOLIA PULCHRA PULCHRA	0	0	0
143 SALIX RETICULATA RETICULATA	0	0	0
144 SALIX ROTUNDIFOLIA ROTUNDIFOLIA	0	5.0	0
145 SAUSSUREA ANGUSTIFOLIA	0	0	0
146 SAXIFRAGA CAESPITOSA	0	3.0	0
147 SAXIFRAGA CERNUA	0	0	0
148 SAXIFRAGA FOLIOLOSA	0	0	0
149 SAXIFRAGA HIERACIFOLIA	0	1	0
150 SAXIFRAGA HIRCULUS PROPINQUA	0	0	0
151 SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	0	2.0	1.0
154 SENECIO ATROPURPUREUS FRIGIDUS	0	0	0
156 SENECIO RESEDIFOLIUS	0	0	0
157 SILENE ACAULIS	0	0	0
159 SILENE WAHLBERGELLA ARCTICA	0	0	0
160 STELLARIA HUMIFUSA	0	0	0
161 STELLARIA LAETA	.1	0	0
164 TARAXACUM PHYMATOCARPUM	0	0	0
165 THALICTRUM ALPINUM	0	0	0
168 TRISETUM SPICATUM SPICATUM	0	0	.1
169 UTRICULARIA VULGARIS MACRORHIZA	0	0	0
172 WILHELMSIA PHYSODES	0	0	.1
901 UNKNOWN MONOCOT	0	5.0	0
902 UNKNOWN DICOT	0	0	0
LIVERWORTS			
173 ANEURA PINGUIS	0	0	0
426 ANASTROPHYLLUM MINUTUM	0	.1	0
175 BLEPHAROSTOMA TRICHOPHYLLUM BREVIRETE	0	0	0
397 CALYPOGEIA MUELLERIANA	0	0	0
460 GYMNOCOLEA INFLATA	0	0	0
441 HARPANTHUS FLOTOWIANUS	0	0	0
405 LOPHOZIA BINSTEADII	0	0	0
433 LOPHOZIA HETEROCOLPA	0	0	0
407 LOPHOZIA QUADRILOBA	0	0	0
486 LOPHOZIA SP.	0	0	0
182 PLAGIOCHILA ARCTICA	0	0	0
184 PTILIDIUM CILIARE	0	0	0
185 RADULA PROLIFERA	0	0	0
406 SCAPANIA SIMMONSII	0	0	0
188 UNKNOWN LEAFY LIVERWORTS	0	0	0
189 UNKNOWN THALLOID LIVERWORTS	0	0	0
MOSSES			
192 AULACOMNIUM ACUMINATUM	0	5.0	0
193 AULACOMNIUM PALUSTRE	0	.1	0
194 AULACOMNIUM TURGIDUM	0	0	0
448 BRACHYTHECIACEAE	0	0	0
432 BRACHYTHECIUM GROENLANDICUM	0	0	0
196 BRACHYTHECIUM TURGIDUM	0	0	0
440 BRYUM ALGOVICUM	0	0	0
198 BRYUM ARCTICUM	0	.1	0
205 BRYUM STENOTRICHUM	0	.1	0
439 BRYUM TORTIFOLIUM	0	0	0
206 BYRUM WRIGHTII	0	0	0
383 BRYUM SP.	0	1.0	0
209 CALLIERGON RICHARDSONII ROBUSTUM	0	0	0
212 CALLIERGON SP.	0	0	0
213 CAMPYLIUM STELLATUM	0	0	0
214 CATOSCOPIUM NIGRITUM	0	0	0
215 CERATODON PURPUREUS	0	.1	0
216 CINCLIDIUM ARCTICUM	0	0	0
217 CINCLIDIUM LATIFOLIUM	0	0	0
411 CINCLIDIUM STYGIUM	0	0	0
449 CINCLIDIUM SP.	0	0	0
218 CIRRIPHYLLUM CIRROSUM	0	0	0
219 CRATONEURON ARCTICUM	0	.1	0
221 CTENIDIUM MOLLUSCUM	0	0	0
225 CYRTOMNIUM HYMENOPHYLLUM	0	0	0
227 DICRANUM ANGUSTUM	0	2.0	0
228 DICRANUM ELONGATUM	0	2.0	0
390 DICRANUM SP.	0	0	0
229 DIDYMODON ASPERIFOLIUS	0	0	0
230 DISTICHIUM CAPILLACEUM	0	0	0
232 DISTICHIUM INCLINATUM	0	0	0
233 DITRICHUM FLEXICAULE	0	0	0
236 DREPANOCLADUS BREVIFOLIUS	0	0	0
237 DREPANOCLADUS REVOLVENS	0	0	0
238 DREPANOCLADUS UNCINATUS	0	5.0	0
239 DREPANOCLADUS SP.	0	0	0
240 ENCALYPTA ALPINA	0	0	0
241 ENCALYPTA PROCERA	0	0	0
244 ENCALYPTA SP.	0	0	0
246 FISSIDENS OSMUNDOIDES	0	0	0
450 FISSIDENS SP	0	0	0
247 FUNARIA ARCTICA	0	0	0
250 HYLOCOMIUM SPLENDENS OBTUSIFOLIUM	0	3.0	0
251 HYPNUM BAMBERGERI	0	0	0
252 HYPNUM CUPRESSIFORME	0	0	0
253 HYPNUM PROCERRIMUM	0	0	0
254 HYPNUM REVOLUTUM	0	0	0
256 HYPNUM SP.	0	0	0
257 LEPTOBRYUM PYRIFORME	0	0	0
258 MEESIA TRIQUETRA	0	0	0
259 MEESIA ULIGINOSA	0	.1	0
144 MNIUM ANDREWSIANUM	0	0	0
260 MNIUM BLYTTII	0	0	0
451 PLAGIOMNIUM ELLIPTICUM	0	0	0
262 MYURELLA JULACEA	0	0	0
264 ONCOPHORUS WAHLENBERGII	0	.1	0
265 ORTHOTHECIUM CHRYSEUM	0	0	0
268 PHILONOTIS FONTANA PUMILA	0	0	0
110 PLAGIOPUS OEDERIANA	0	0	0
272 POGONATUM ALPINUM	0	1.0	0
446 POLYTRICHACEAE	0	0	0
275 POHLIA NUTANS	0	0	0
404 POHLIA SP.	0	0	0
276 RHACOMITRIUM LANUGINOSUM	0	0	0
278 RHYTIDIUM RUGOSUM	0	4.0	0
279 SCORPIDIUM SCORPIOIDES	0	0	0
280 SCORPIDIUM TURGESCENS	0	0	0
282 SPLACHNUM VASCULOSUM	0	0	0

Table B6 (cont'd.). Raw species data for larger plots.
The units are percentage of cover.

	1202	1422	1521
283 STEGONIA LATIFOLIA PILIFERA	0	0	0
285 TETRAPLODON MNIOIDES	0	0	0
287 THUIDIUM ABIETINUM	0	20.0	0
288 TIMMIA AUSTRIACA	0	.1	0
289 TIMMIA MEGAPOLITANA BAVARICA	0	0	0
290 TIMMIA NORVEGICA	0	0	0
291 TOMENTHYPNUM NITENS	0	2.0	0
292 TORTELLA ARCTICA	0	0	0
296 TORTULA RURALIS	0	0	0
298 VOITIA HYPERBOREA	0	0	0
903 UNKNOWN MOSS	0	0	0
LICHENS			
299 ALECTORIA NIGRICANS	0	0	0
300 ALECTORIA OCHROLEUCA	0	0	0
307 CALOPLACA SP.	0	0	0
310 CETRARIA CUCULLATA	0	.1	0
311 CETRARIA DELISEI	0	0	0
312 CETRARIA ISLANDICA	0	.1	0
314 CETRARIA NIVALIS	0	0	0
315 CETRARIA RICHARDSONII	0	0	0
316 CETRARIA TILESII	0	0	0
365 CLADONIA GRACILIS	0	0	0
318 CLADONIA LEPIDOTA	0	0	0
427 CLADONIA PHYLLOPHORA	0	0	0
319 CLADONIA POCILLUM	0	0	0
320 CLADONIA SQUAMOSA	0	0	0
322 CLADONIA SP.	0	0	0
327 CORNICULARIA DIVERGENS	0	0	0
328 DACTYLINA ARCTICA	0	0	0
329 DACTYLINA RAMULOSA	0	0	0
330 EVERNIA PERFRAGILIS	0	0	0
331 FULGENSIA BRACTEATA	0	0	0
332 GYALECTA FOVEOLARIS	0	0	0
334 HYPOGYMNIA SUBOBSCURA	0	0	0
336 LECANORA EPIBRYON	0	0	0
428 LECIDEA RAMULOSA	0	0	0
339 LECIDEA VERNALIS	0	0	0
393 LEPTOGIUM SINNUATUM	0	0	0
342 LOPADIUM FECUNDUM	0	0	0
343 OCHROLECHIA FRIGIDA	0	0	0
413 OCHROLECHIA FRIGIDA THELEPHOROIDES	0	0	0
348 PELTIGERA APHTHOSA	0	2.0	0
349 PELTIGERA CANINA S.L.	0	0	0
353 PELTIGERA SPURIA SOREDIATA	0	0	0
418 PERTUSARIA CORIACEA	0	0	0
355 PERTUSARIA DACTYLINA	0	0	0
384 PERTUSARIA SP	0	0	0
360 PHYSCONIA MUSCIGENA	0	0	0
412 PSOROMA HYPNORUM	0	0	0
400 SOLORINA SP.	0	0	0
369 SPHAEROPHORUS GLOBOSUS	0	0	0
370 STEREOCAULON ALPINUM	0	0	0
372 THAMNOLIA SUBULIFORMIS	0	0	0
429 TONINIA CUMULATA	0	0	0
375 XANTHORIA ELEGANS	0	0	0
403 UNKNOWN CRUSTOSE LICHEN	.1	0	0
378 UNKNOWN FRUTICOSE LICHEN	0	0	0
379 NOSTOC COMMUNE	0	0	0
380 NOSTOC SP.	0	0	0

APPENDIX C. ENVIRONMENTAL AND VEGETATION DATA SUMMARIES FOR ALL STAND TYPES

Table C1. Environmental data summaries for all stand types. The variables and their units are described in Table 6.

STAND TYPE B1
NUMBER OF PLOTS 6
PLOT NUMBERS 010B 1001 1411 1505 1513 1520

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	68.0000	22.7688	2	SLOPE	1.3333	1.5055	6
SILT	20.1500	15.3442	2	THAW77	52.6667	16.7770	6
CLAY	11.8500	7.4246	2	H2ODPTH	0.0000	0.0000	6
HYGMOIS	2.0833	0.7960	6	SOILCOV	12.0000	4.6476	6
ORGMAT	11.0333	4.9127	6	ROCKCOV	7.5000	9.8742	6
H2OABSN	70.2667	16.0662	6	H2OCOV	0.0000	0.0000	6
FLDCAP	25.6167	10.8291	6	MARL	0.0000	0.0000	6
WILTPT	18.4833	7.8260	6	BEAR	0.0000	0.0000	6
AVH2O	7.1500	4.3501	6	FOX	0.0167	0.0408	6
BDENS77	0.8550	0.2700	6	CARFECE	0.3167	0.2317	6
SMOIS77	30.5000	16.3799	6	CARGRAZ	0.0000	0.0000	6
PH	7.6583	0.1525	6	SQRRL	0.0333	0.0816	6
NH4	11.4667	3.4645	6	BRWNLEM	0.0000	0.0000	6
NO3	12.5833	3.5656	6	COLLEM	0.0000	0.0000	6
CO3	10.9333	7.2792	6	PTARMIG	0.0333	0.0516	6
P	13.8350	1.4708	6	GOOSE	0.0000	0.0000	6
K	357.1667	217.7819	6	MISBIRD	0.0500	0.1225	6
CA	5218.5000	1246.9927	6	BRYOCOV	5.6667	2.9439	6
MG	233.8333	60.5158	6	FLICCOV	5.0000	2.7568	6
MOISREG	1.0000	0.0000	6	CLICCOV	13.8333	6.8240	6
SNOWREG	1.6667	1.2111	6	ERECDED	2.1667	1.6021	6
CRYOREG	3.0000	0.6325	6	PROSDED	23.3333	9.3310	6
HUMMOCK	2.0000	0.6325	6				

STAND TYPE B2
NUMBER OF PLOTS 3
PLOT NUMBERS 010A 1401 1412

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	37.7000	18.1019	2	SLOPE	0.0000	0.0000	3
SILT	43.0000	18.5262	2	THAW77	35.0000	8.1854	3
CLAY	19.3000	0.4243	2	H2ODPTH	0.0000	0.0000	3
HYGMOIS	4.6333	3.7287	3	SOILCOV	10.3333	9.0738	3
ORGMAT	23.7667	18.8386	3	ROCKCOV	0.6667	0.5774	3
H2OABSN	117.8667	56.5937	3	H2OCOV	0.0000	0.0000	3
FLDCAP	55.9667	37.8342	3	MARL	0.0000	0.0000	3
WILTPT	35.8000	27.5033	3	BEAR	0.0000	0.0000	2
AVH2O	20.1667	10.3607	3	FOX	0.0500	0.0707	2
BDENS77	0.7800	0.3051	3	CARFECE	0.4500	0.3536	2
SMOIS77	39.3333	35.2184	3	CARGRAZ	0.0000	0.0000	2
PH	7.1300	0.4498	3	SQRRL	0.0000	0.0000	2
NH4	11.3333	3.3307	3	BRWNLEM	0.0000	0.0000	2
NO3	19.8000	17.6576	3	COLLEM	0.0500	0.0707	2
CO3	7.3000	11.0014	3	PTARMIG	0.6500	0.2121	2
P	14.0000	14.9332	3	GOOSE	0.0000	0.0000	2
K	310.6667	194.5619	3	MISBIRD	0.1000	0.1414	2
CA	6484.3333	3602.1164	3	BRYOCOV	10.6667	5.1316	3
MG	437.3333	376.4257	3	FLICCOV	5.3333	4.0415	3
MOISREG	1.0000	0.0000	3	CLICCOV	11.3333	4.1633	3
SNOWREG	2.0000	0.0000	3	ERECDED	1.6667	1.1547	3
CRYOREG	3.0000	0.0000	3	PROSDED	37.6667	15.0444	3
HUMMOCK	2.0000	0.0000	3				

STAND TYPE B3
NUMBER OF PLOTS 3
PLOT NUMBERS 0801 1419 1506

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	26.5000	0.0000	1	SLOPE	0.0000	0.0000	3
SILT	50.9000	0.0000	1	THAW77	45.3333	16.5630	3
CLAY	22.6000	0.0000	1	H2ODPTH	0.0000	0.0000	3
HYGMOIS	2.7000	2.1794	3	SOILCOV	22.3333	16.6233	3
ORGMAT	13.4000	11.3080	3	ROCKCOV	0.0000	0.0000	3
H2OABSN	72.5000	30.7365	3	H2OCOV	0.0000	0.0000	3
FLDCAP	40.9000	27.9628	3	MARL	0.0000	0.0000	3
WILTPT	18.7333	14.8028	3	BEAR	0.0000	0.0000	2
AVH2O	21.8333	13.4098	3	FOX	0.0000	0.0000	2
BDENS77	1.1900	0.5024	3	CARFECE	0.0000	0.0000	2
SMOIS77	37.6667	39.2598	3	CARGRAZ	0.0000	0.0000	2
PH	7.4267	0.6038	3	SQRRL	0.0000	0.0000	2
NH4	8.7000	1.3892	3	BRWNLEM	0.0000	0.0000	2
NO3	20.1333	19.8394	3	COLLEM	0.0000	0.0000	2
CO3	19.4667	19.1865	3	PTARMIG	0.0000	0.0000	2
P	4.6667	4.7258	3	GOOSE	0.0000	0.0000	2
K	125.0000	79.2654	3	MISBIRD	0.0000	0.0000	2
CA	4542.3333	2367.1156	3	BRYOCOV	12.0000	15.7162	3
MG	371.0000	284.8789	3	FLICCOV	8.0000	1.7321	3
MOISREG	2.6667	0.5774	3	CLICCOV	10.3333	7.5056	3
SNOWREG	3.0000	0.0000	3	ERECDED	6.0000	4.5826	3
CRYOREG	4.0000	0.0000	3	PROSDED	22.3333	17.7858	3
HUMMOCK	2.0000	0.0000	3				

Table C1 (cont'd). Environmental data summaries for all stand types.

The variables and their units are described in Table 6.

STAND TYPE B4
NUMBER OF PLOTS 2
PLOT NUMBERS 1105 1521

SAND	72.2000	0.0000	1	SLOPE	0.5000	0.7071	2
SILT	21.7000	0.0000	1	THAW77	100.0000	0.0000	1
CLAY	6.1000	0.0000	1	H2ODPTH	0.0000	0.0000	1
HYGMOIS	0.5000	0.0000	1	SOILCOV	96.5000	2.1213	2
ORGMAT	2.1000	0.0000	1	ROCKCOV	87.5000	10.6066	2
H2OABSN	27.0000	0.0000	1	H2OCOV	0.0000	0.0000	2
FLDCAP	7.5000	0.0000	1	MARL	0.0000	0.0000	2
WILTPT	2.8000	0.0000	1	BEAR	0.0000	0.0000	1
AVH2O	4.7000	0.0000	1	FOX	0.0000	0.0000	1
BDENS77	1.5400	0.0000	1	CARFECE	0.0000	0.0000	1
SMOIS77	6.0000	0.0000	1	CARGRAZ	0.0000	0.0000	1
PH	7.8000	0.0000	1	SQRRL	0.0000	0.0000	1
NH4	7.1000	0.0000	1	BRWNLEM	0.0000	0.0000	1
NO3	5.2000	0.0000	1	COLLEM	0.0000	0.0000	1
CO3	1.1000	0.0000	1	PTARMIG	0.0000	0.0000	1
P	0.1000	0.0000	1	GOOSE	0.0000	0.0000	1
K	26.0000	0.0000	1	MISBIRD	0.0000	0.0000	1
CA	623.0000	0.0000	1	BRYOCOV	0.0000	0.0000	2
MG	45.0000	0.0000	1	FLICCOV	0.0000	0.0000	2
MOISREG	1.0000	0.0000	2	CLICCOV	0.0000	0.0000	2
SNOWREG	3.0000	2.8284	2	ERECDED	0.0000	0.0000	2
CRYOREG	1.0000	0.0000	2	PROSDED	1.5000	0.7071	2
HUMMOCK	1.0000	0.0000	2				

STAND TYPE B5
NUMBER OF PLOTS 1
PLOT NUMBERS 1207

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	31.8000	0.0000	1	SLOPE	0.0000	0.0000	1
SILT	58.7000	0.0000	1	THAW77	64.0000	0.0000	1
CLAY	9.5000	0.0000	1	H2ODPTH	0.0000	0.0000	1
HYGMOIS	0.9000	0.0000	1	SOILCOV	40.0000	0.0000	1
ORGMAT	5.5000	0.0000	1	ROCKCOV	0.0000	0.0000	1
H2OABSN	0.0000	0.0000	0	H2OCOV	0.0000	0.0000	1
FLDCAP	0.0000	0.0000	0	MARL	0.0000	0.0000	1
WILTPT	0.0000	0.0000	0	BEAR	0.0000	0.0000	1
AVH2O	0.0000	0.0000	0	FOX	0.0000	0.0000	1
BDENS77	1.1500	0.0000	1	CARFECE	0.2000	0.0000	1
SMOIS77	7.0000	0.0000	1	CARGRAZ	0.0000	0.0000	1
PH	8.0000	0.0000	1	SQRRL	0.1000	0.0000	1
NH4	0.0000	0.0000	0	BRWNLEM	0.0000	0.0000	1
NO3	0.0000	0.0000	0	COLLEM	0.0000	0.0000	1
CO3	27.2000	0.0000	1	PTARMIG	0.0000	0.0000	1
P	0.0000	0.0000	0	GOOSE	0.0000	0.0000	1
K	0.0000	0.0000	0	MISBIRD	0.1000	0.0000	1
CA	0.0000	0.0000	0	BRYOCOV	1.0000	0.0000	1
MG	0.0000	0.0000	0	FLICCOV	0.0000	0.0000	1
MOISREG	1.0000	0.0000	1	CLICCOV	1.0000	0.0000	1
SNOWREG	1.0000	0.0000	1	ERECDED	0.0000	0.0000	1
CRYOREG	2.0000	0.0000	1	PROSDED	30.0000	0.0000	1
HUMMOCK	2.0000	0.0000	1				

STAND TYPE B6
NUMBER OF PLOTS 1
PLOT NUMBERS 1507

SAND	0.0000	0.0000	0	SLOPE	2.0000	0.0000	1
SILT	0.0000	0.0000	0	THAW77	68.0000	0.0000	1
CLAY	0.0000	0.0000	0	H2ODPTH	0.0000	0.0000	1
HYGMOIS	1.4000	0.0000	1	SOILCOV	8.0000	0.0000	1
ORGMAT	6.2000	0.0000	1	ROCKCOV	0.0000	0.0000	1
H2OABSN	60.2000	0.0000	1	H2OCOV	0.0000	0.0000	1
FLDCAP	19.3000	0.0000	1	MARL	0.0000	0.0000	1
WILTPT	11.7000	0.0000	1	BEAR	0.0000	0.0000	1
AVH2O	7.6000	0.0000	1	FOX	0.0000	0.0000	1
BDENS77	1.0100	0.0000	1	CARFECE	0.3000	0.0000	1
SMOIS77	27.0000	0.0000	1	CARGRAZ	0.0000	0.0000	1
PH	7.7300	0.0000	1	SQRRL	0.0000	0.0000	1
NH4	8.3000	0.0000	1	BRWNLEM	0.0000	0.0000	1
NO3	14.8000	0.0000	1	COLLEM	0.4000	0.0000	1
CO3	17.6000	0.0000	1	PTARMIG	0.0000	0.0000	1
P	9.0000	0.0000	1	GOOSE	0.0000	0.0000	1
K	402.0000	0.0000	1	MISBIRD	0.3000	0.0000	1
CA	3611.0000	0.0000	1	BRYOCOV	38.0000	0.0000	1
MG	138.0000	0.0000	1	FLICCOV	0.0000	0.0000	1
MOISREG	1.0000	0.0000	1	CLICCOV	1.0000	0.0000	1
SNOWREG	5.0000	0.0000	1	ERECDED	2.0000	0.0000	1
CRYOREG	3.0000	0.0000	1	PROSDED	27.0000	0.0000	1
HUMMOCK	3.0000	0.0000	1				

Table C1 (cont'd).

STAND TYPE B7
NUMBER OF PLOTS 1
PLOT NUMBERS 1104

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	31.9000	0.0000	1	SLOPE	3.0000	0.0000	1
SILT	51.7000	0.0000	1	THAW77	100.0000	0.0000	1
CLAY	16.4000	0.0000	1	H2ODPTH	0.0000	0.0000	1
HYGMOIS	2.6000	0.0000	1	SOILCOV	80.0000	0.0000	1
ORGMAT	14.5000	0.0000	1	ROCKCOV	1.0000	0.0000	1
H2OABSN	108.2000	0.0000	1	H2OCOV	0.0000	0.0000	1
FLDCAP	40.7000	0.0000	1	MARL	0.0000	0.0000	1
WILTPT	28.1000	0.0000	1	BEAR	0.0000	0.0000	0
AVH2O	12.6000	0.0000	1	FOX	0.0000	0.0000	0
BDENS77	0.9300	0.0000	1	CARFECE	0.0000	0.0000	0
SMOIS77	21.0000	0.0000	1	CARGRAZ	0.0000	0.0000	0
PH	7.5000	0.0000	1	SQRRL	0.0000	0.0000	0
NH4	9.1000	0.0000	1	BRWNLEM	0.0000	0.0000	0
NO3	12.7000	0.0000	1	COLLEM	0.0000	0.0000	0
CO3	2.9000	0.0000	1	PTARMIG	0.0000	0.0000	0
P	1.0000	0.0000	1	GOOSE	0.0000	0.0000	0
K	32.0000	0.0000	1	MISBIRD	0.0000	0.0000	0
CA	3439.0000	0.0000	1	BRYOCOV	1.0000	0.0000	1
MG	181.0000	0.0000	1	FLICCOV	0.0000	0.0000	1
MOISREG	2.0000	0.0000	1	CLICCOV	0.0000	0.0000	1
SNOWREG	4.0000	0.0000	1	ERECDED	3.0000	0.0000	1
CRYOREG	1.0000	0.0000	1	PROSDED	1.0000	0.0000	1
HUMMOCK	3.0000	0.0000	1				

STAND TYPE B8
NUMBER OF PLOTS 1
PLOT NUMBERS 1312

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	87.6000	0.0000	1	SLOPE	0.0000	0.0000	1
SILT	6.4000	0.0000	1	THAW77	43.0000	0.0000	1
CLAY	6.0000	0.0000	1	H2ODPTH	0.0000	0.0000	1
HYGMOIS	5.0000	0.0000	1	SOILCOV	85.0000	0.0000	1
ORGMAT	47.3000	0.0000	1	ROCKCOV	0.0000	0.0000	1
H2OABSN	0.0000	0.0000	0	H2OCOV	0.0000	0.0000	1
FLDCAP	0.0000	0.0000	0	MARL	0.0000	0.0000	1
WILTPT	0.0000	0.0000	0	BEAR	0.0000	0.0000	1
AVH2O	0.0000	0.0000	0	FOX	0.0000	0.0000	1
BDENS77	0.4200	0.0000	1	CARFECE	0.1000	0.0000	1
SMOIS77	119.0000	0.0000	1	CARGRAZ	0.0000	0.0000	1
PH	5.9000	0.0000	1	SQRRL	0.0000	0.0000	1
NH4	0.0000	0.0000	0	BRWNLEM	0.0000	0.0000	1
NO3	0.0000	0.0000	0	COLLEM	0.0000	0.0000	1
CO3	0.0000	0.0000	1	PTARMIG	0.0000	0.0000	1
P	0.0000	0.0000	0	GOOSE	0.4000	0.0000	1
K	0.0000	0.0000	0	MISBIRD	0.0000	0.0000	1
CA	0.0000	0.0000	0	BRYOCOV	0.0000	0.0000	1
MG	0.0000	0.0000	0	FLICCOV	0.0000	0.0000	1
MOISREG	2.0000	0.0000	1	CLICCOV	0.0000	0.0000	1
SNOWREG	1.0000	0.0000	1	ERECDED	3.0000	0.0000	1
CRYOREG	1.0000	0.0000	1	PROSDED	2.0000	0.0000	1
HUMMOCK	2.0000	0.0000	1				

STAND TYPE B9
NUMBER OF PLOTS 1
PLOT NUMBERS 1201

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	76.2000	0.0000	1	SLOPE	2.0000	0.0000	1
SILT	16.9000	0.0000	1	THAW77	92.0000	0.0000	1
CLAY	6.9000	0.0000	1	H2ODPTH	0.0000	0.0000	1
HYGMOIS	0.3000	0.0000	1	SOILCOV	90.0000	0.0000	1
ORGMAT	1.1000	0.0000	1	ROCKCOV	0.0000	0.0000	1
H2OABSN	29.7000	0.0000	1	H2OCOV	0.0000	0.0000	1
FLDCAP	4.4000	0.0000	1	MARL	0.0000	0.0000	1
WILTPT	2.1000	0.0000	1	BEAR	0.0000	0.0000	1
AVH2O	2.3000	0.0000	1	FOX	0.0000	0.0000	1
BDENS77	1.2700	0.0000	1	CARFECE	0.0000	0.0000	1
SMOIS77	3.0000	0.0000	1	CARGRAZ	0.0000	0.0000	1
PH	8.3000	0.0000	1	SQRRL	0.2000	0.0000	1
NH4	9.1000	0.0000	1	BRWNLEM	0.0000	0.0000	1
NO3	4.4000	0.0000	1	COLLEM	0.0000	0.0000	1
CO3	30.9000	0.0000	1	PTARMIG	0.0000	0.0000	1
P	0.1000	0.0000	1	GOOSE	0.0000	0.0000	1
K	11.0000	0.0000	1	MISBIRD	0.0000	0.0000	1
CA	1450.0000	0.0000	1	BRYOCOV	0.0000	0.0000	1
MG	52.0000	0.0000	1	FLICCOV	0.0000	0.0000	1
MOISREG	1.0000	0.0000	1	CLICCOV	0.0000	0.0000	1
SNOWREG	2.0000	0.0000	1	ERECDED	4.0000	0.0000	1
CRYOREG	1.0000	0.0000	1	PROSDED	0.0000	0.0000	1
HUMMOCK	1.0000	0.0000	1				

Table C1 (cont'd). Environmental data summaries for all stand types. The variables and their units are described in Table 6.

STAND TYPE B10
NUMBER OF PLOTS 1
PLOT NUMBERS 1301

SAND	21.8000	0.0000	1	SLOPE	1.0000	0.0000	1
SILT	62.6000	0.0000	1	THAW77	44.0000	0.0000	1
CLAY	15.6000	0.0000	1	H2ODPTH	0.0000	0.0000	1
HYGMOIS	1.2000	0.0000	1	SOILCOV	25.0000	0.0000	1
ORGMAT	7.4000	0.0000	1	ROCKCOV	0.0000	0.0000	1
H2OABSN	73.2000	0.0000	1	H2OCOV	0.0000	0.0000	1
FLDCAP	24.2000	0.0000	1	MARL	0.0000	0.0000	1
WILTPT	14.5000	0.0000	1	BEAR	0.0000	0.0000	0
AVH2O	9.7000	0.0000	1	FOX	0.0000	0.0000	0
BDENS77	0.9700	0.0000	1	CARFECE	0.0000	0.0000	0
SMOIS77	29.0000	0.0000	1	CARGRAZ	0.0000	0.0000	0
PH	7.9000	0.0000	1	SQRRL	0.0000	0.0000	0
NH4	13.3000	0.0000	1	BRWNLEM	0.0000	0.0000	0
NO3	9.3000	0.0000	1	COLLEM	0.0000	0.0000	0
CO3	29.9000	0.0000	1	PTARMIG	0.0000	0.0000	0
P	0.1000	0.0000	1	GOOSE	0.0000	0.0000	0
K	36.0000	0.0000	1	MISBIRD	0.0000	0.0000	0
CA	1627.0000	0.0000	1	BRYOCOV	1.0000	0.0000	1
MG	274.0000	0.0000	1	FLICCOV	3.0000	0.0000	1
MOISREG	1.0000	0.0000	1	CLICCOV	5.0000	0.0000	1
SNOWREG	1.0000	0.0000	1	ERECDED	45.0000	0.0000	1
CRYOREG	2.0000	0.0000	1	PROSDED	30.0000	0.0000	1
HUMMOCK	2.0000	0.0000	1				

STAND TYPE B12
NUMBER OF PLOTS 1
PLOT NUMBERS 1305

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	36.8000	0.0000	1	SLOPE	0.0000	0.0000	1
SILT	26.6000	0.0000	1	THAW77	23.0000	0.0000	1
CLAY	36.6000	0.0000	1	H2ODPTH	0.0000	0.0000	1
HYGMOIS	5.2000	0.0000	1	SOILCOV	15.0000	0.0000	1
ORGMAT	29.9000	0.0000	1	ROCKCOV	0.0000	0.0000	1
H2OABSN	108.0000	0.0000	1	H2OCOV	0.0000	0.0000	1
FLDCAP	63.6000	0.0000	1	MARL	0.0000	0.0000	1
WILTPT	42.4000	0.0000	1	BEAR	0.0000	0.0000	1
AVH2O	21.2000	0.0000	1	FOX	0.0000	0.0000	1
BDENS77	0.7200	0.0000	1	CARFECE	0.2000	0.0000	1
SMOIS77	50.0000	0.0000	1	CARGRAZ	0.0000	0.0000	1
PH	5.5000	0.0000	1	SQRRL	0.0000	0.0000	1
NH4	12.7000	0.0000	1	BRWNLEM	0.0000	0.0000	1
NO3	14.3000	0.0000	1	COLLEM	0.0000	0.0000	1
CO3	0.1000	0.0000	1	PTARMIG	0.0000	0.0000	1
P	3.0000	0.0000	1	GOOSE	0.0000	0.0000	1
K	349.0000	0.0000	1	MISBIRD	0.1000	0.0000	1
CA	3648.0000	0.0000	1	BRYOCOV	3.0000	0.0000	1
MG	627.0000	0.0000	1	FLICCOV	3.0000	0.0000	1
MOISREG	2.0000	0.0000	1	CLICCOV	40.0000	0.0000	1
SNOWREG	2.0000	0.0000	1	ERECDED	3.0000	0.0000	1
CRYOREG	3.0000	0.0000	1	PROSDED	5.0000	0.0000	1
HUMMOCK	3.0000	0.0000	1				

STAND TYPE B13
NUMBER OF PLOTS 3
PLOT NUMBERS 1106 1202 1208

SAND	60.7000	15.8392	2	SLOPE	1.0000	1.0000	3
SILT	30.5000	14.1421	2	THAW77	74.3333	18.3394	3
CLAY	8.8000	1.6971	2	H2ODPTH	0.0000	0.0000	3
HYGMOIS	0.6500	0.0707	2	SOILCOV	56.6667	23.0940	3
ORGMAT	3.3500	0.7778	2	ROCKCOV	0.0000	0.0000	3
H2OABSN	43.6000	0.8485	2	H2OCOV	0.0000	0.0000	3
FLDCAP	10.0000	1.2728	2	MARL	0.0000	0.0000	3
WILTPT	5.9500	1.2021	2	BEAR	0.0000	0.0000	2
AVH2O	4.0500	0.0707	2	FOX	0.0000	0.0000	2
BDENS77	1.2633	0.0289	3	CARFECE	0.0000	0.0000	2
SMOIS77	7.6667	4.5092	3	CARGRAZ	0.0000	0.0000	2
PH	8.0000	0.5657	2	SQRRL	0.1500	0.0707	2
NH4	13.7500	1.3435	2	BRWNLEM	0.0000	0.0000	2
NO3	4.6000	0.4243	2	COLLEM	0.0000	0.0000	2
CO3	17.6500	22.2739	2	PTARMIG	0.0000	0.0000	2
P	0.1000	0.0000	2	GOOSE	0.0000	0.0000	2
K	28.5000	3.5355	2	MISBIRD	0.0000	0.0000	2
CA	1400.5000	82.7315	2	BRYOCOV	1.0000	1.0000	3
MG	97.5000	40.3051	2	FLICCOV	0.0000	0.0000	3
MOISREG	1.0000	0.0000	3	CLICCOV	0.6667	0.5774	3
SNOWREG	1.6667	0.5774	3	ERECDED	8.6667	14.1539	3
CRYOREG	1.3333	0.5774	3	PROSDED	2.3333	2.3094	3
HUMMOCK	1.0000	0.0000	3				

Table C1 (cont'd).

STAND TYPE B14
NUMBER OF PLOTS 1
PLOT NUMBERS 1421

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	0.0000	0.0000	0	SLOPE	3.0000	0.0000	1
SILT	0.0000	0.0000	0	THAW77	0.0000	0.0000	0
CLAY	0.0000	0.0000	0	H2ODPTH	0.0000	0.0000	0
HYGMOIS	0.0000	0.0000	0	SOILCOV	1.0000	0.0000	1
ORGMAT	0.0000	0.0000	0	ROCKCOV	0.0000	0.0000	1
H2OABSN	0.0000	0.0000	0	H2OCOV	0.0000	0.0000	1
FLDCAP	0.0000	0.0000	0	MARL	0.0000	0.0000	1
WILTPT	0.0000	0.0000	0	BEAR	0.0000	0.0000	1
AVH2O	0.0000	0.0000	0	FOX	0.0000	0.0000	1
BDENS77	0.0000	0.0000	0	CARFECE	0.0000	0.0000	1
SMOIS77	0.0000	0.0000	0	CARGRAZ	0.0000	0.0000	1
PH	0.0000	0.0000	0	SQRRL	0.0000	0.0000	1
NH4	0.0000	0.0000	0	BRWNLEM	0.0000	0.0000	1
NO3	0.0000	0.0000	0	COLLEM	0.1000	0.0000	1
CO3	0.0000	0.0000	0	PTARMIG	0.0000	0.0000	1
P	0.0000	0.0000	0	GOOSE	0.0000	0.0000	1
K	0.0000	0.0000	0	MISBIRD	0.0000	0.0000	1
CA	0.0000	0.0000	0	BRYOCOV	25.0000	0.0000	1
MG	0.0000	0.0000	0	FLICCOV	1.0000	0.0000	1
MOISREG	2.0000	0.0000	1	CLICCOV	2.0000	0.0000	1
SNOWREG	4.0000	0.0000	1	ERECDED	25.0000	0.0000	1
CRYOREG	2.0000	0.0000	1	PROSDED	10.0000	0.0000	1
HUMMOCK	3.0000	0.0000	1				

STAND TYPE B15
NUMBER OF PLOTS 1
PLOT NUMBERS 1313

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	92.7000	0.0000	1	SLOPE	0.0000	0.0000	1
SILT	4.1000	0.0000	1	THAW77	25.0000	0.0000	1
CLAY	3.2000	0.0000	1	H2ODPTH	0.0000	0.0000	1
HYGMOIS	7.4000	0.0000	1	SOILCOV	25.0000	0.0000	1
ORGMAT	70.4000	0.0000	1	ROCKCOV	0.0000	0.0000	1
H2OABSN	231.6000	0.0000	1	H2OCOV	0.0000	0.0000	1
FLDCAP	119.5000	0.0000	1	MARL	0.0000	0.0000	1
WILTPT	96.3000	0.0000	1	BEAR	0.0000	0.0000	1
AVH2O	23.2000	0.0000	1	FOX	0.0000	0.0000	1
BDENS77	0.3100	0.0000	1	CARFECE	0.6000	0.0000	1
SMOIS77	171.0000	0.0000	1	CARGRAZ	0.0000	0.0000	1
PH	5.0000	0.0000	1	SQRRL	0.0000	0.0000	1
NH4	0.0000	0.0000	0	BRWNLEM	0.0000	0.0000	1
NO3	0.0000	0.0000	0	COLLEM	0.0000	0.0000	1
CO3	0.0000	0.0000	1	PTARMIG	0.0000	0.0000	1
P	0.0000	0.0000	0	GOOSE	0.0000	0.0000	1
K	0.0000	0.0000	0	MISBIRD	0.0000	0.0000	1
CA	0.0000	0.0000	0	BRYOCOV	2.0000	0.0000	1
MG	0.0000	0.0000	0	FLICCOV	2.0000	0.0000	1
MOISREG	3.0000	0.0000	1	CLICCOV	25.0000	0.0000	1
SNOWREG	3.0000	0.0000	1	ERECDED	15.0000	0.0000	1
CRYOREG	3.0000	0.0000	1	PROSDED	5.0000	0.0000	1
HUMMOCK	2.0000	0.0000	1				

STAND TYPE U1
NUMBER OF PLOTS 4
PLOT NUMBERS 1405 1406 1410 1415

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	22.3000	24.1831	2	SLOPE	0.0000	0.0000	4
SILT	47.7500	5.7276	2	THAW77	23.7500	1.5000	4
CLAY	29.9500	18.4555	2	H2ODPTH	0.0000	0.0000	4
HYGMOIS	7.9000	1.8055	4	SOILCOV	5.0000	5.7735	4
ORGMAT	49.6250	6.8446	4	ROCKCOV	0.0000	0.0000	4
H2OABSN	201.1500	25.2561	4	H2OCOV	0.0000	0.0000	4
FLDCAP	95.5000	22.2225	4	MARL	0.0000	0.0000	4
WILTPT	63.9500	11.2420	4	BEAR	0.0000	0.0000	3
AVH2O	31.5250	14.0590	4	FOX	0.0000	0.0000	3
BDENS77	0.3050	0.0624	4	CARFECE	0.2667	0.1528	3
SMOIS77	193.5000	42.0674	4	CARGRAZ	0.0333	0.0577	3
PH	5.8800	0.5331	4	SQRRL	0.0000	0.0000	3
NH4	19.5000	6.7087	4	BRWNLEM	0.0000	0.0000	3
NO3	15.6500	7.3296	4	COLLEM	0.0000	0.0000	3
CO3	0.6000	0.3742	4	PTARMIG	0.0333	0.0577	3
P	2.0000	1.7963	4	GOOSE	0.0000	0.0000	3
K	218.7500	24.7841	4	MISBIRD	0.1667	0.1155	3
CA	6306.5000	2484.8633	4	BRYOCOV	34.0000	20.4613	4
MG	370.0000	119.3678	4	FLICCOV	12.0000	10.0995	4
MOISREG	2.2500	0.5000	4	CLICCOV	7.2500	8.6554	4
SNOWREG	2.7500	0.5000	4	ERECDED	14.7500	6.6018	4
CRYOREG	2.7500	0.5000	4	PROSDED	19.2500	9.3586	4
HUMMOCK	2.7500	0.5000	4				

Table C1 (cont'd). Environmental data summaries for all stand types.
The variables and their units are described in Table 6.

STAND TYPE U2
NUMBER OF PLOTS 1
PLOT NUMBERS 0203

SAND	0.0000	0.0000	0	SLOPE	1.0000	0.0000	1
SILT	0.0000	0.0000	0	THAW77	24.0000	0.0000	1
CLAY	0.0000	0.0000	0	H2ODPTH	0.0000	0.0000	1
HYGMOIS	7.5000	0.0000	1	SOILCOV	0.0000	0.0000	1
ORGMAT	37.3000	0.0000	1	ROCKCOV	0.0000	0.0000	1
H2OABSN	190.0000	0.0000	1	H2OCOV	0.0000	0.0000	1
FLDCAP	88.9000	0.0000	1	MARL	0.0000	0.0000	1
WILTPT	66.3000	0.0000	1	BEAR	0.0000	0.0000	1
AVH2O	22.6000	0.0000	1	FOX	0.0000	0.0000	1
BDENS77	1.0400	0.0000	1	CARFECE	0.4000	0.0000	1
SMOIS77	42.0000	0.0000	1	CARGRAZ	0.0000	0.0000	1
PH	7.3200	0.0000	1	SQRRL	0.0000	0.0000	1
NH4	17.0000	0.0000	1	BRWNLEM	0.0000	0.0000	1
NO3	6.9000	0.0000	1	COLLEM	0.2000	0.0000	1
CO3	4.0000	0.0000	1	PTARMIG	0.0000	0.0000	1
P	17.0000	0.0000	1	GOOSE	0.0000	0.0000	1
K	288.0000	0.0000	1	MISBIRD	0.1000	0.0000	1
CA	9472.0000	0.0000	1	BRYOCOV	87.0000	0.0000	1
MG	348.0000	0.0000	1	FLICCOV	10.0000	0.0000	1
MOISREG	2.0000	0.0000	1	CLICCOV	0.0000	0.0000	1
SNOWREG	3.0000	0.0000	1	ERECDED	9.0000	0.0000	1
CRYOREG	2.0000	0.0000	1	PROSDED	27.0000	0.0000	1
HUMMOCK	3.0000	0.0000	1				

STAND TYPE U3
NUMBER OF PLOTS 8
PLOT NUMBERS 020A 020B 1403 1504 1510 1512 1515 1519

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	13.9333	7.1715	6	SLOPE	0.0000	0.0000	8
SILT	62.4000	8.9898	6	THAW77	29.3750	5.8049	8
CLAY	23.6667	12.7156	6	H2ODPTH	0.0000	0.0000	8
HYGMOIS	4.2625	1.6097	8	SOILCOV	0.5000	0.7559	8
ORGMAT	23.4500	9.7174	8	ROCKCOV	0.0000	0.0000	8
H2OABSN	133.0250	40.3616	8	H2OCOV	0.0000	0.0000	8
FLDCAP	56.0675	18.2766	8	MARL	0.0000	0.0000	8
WILTPT	39.3500	15.5116	8	BEAR	0.0000	0.0000	8
AVH2O	16.7375	7.6300	8	FOX	0.0125	0.0354	8
BDENS77	0.6687	0.1695	8	CARFECE	0.0875	0.1356	8
SMOIS77	82.2500	28.7340	8	CARGRAZ	0.0125	0.0354	8
PH	7.2633	0.5658	8	SQRRL	0.0000	0.0000	8
NH4	10.2714	3.5208	7	BRWNLEM	0.0000	0.0000	8
NO3	10.2571	1.5768	7	COLLEM	0.0000	0.0000	8
CO3	13.5375	8.5920	8	PTARMIG	0.0000	0.0000	8
P	8.8571	3.6253	7	GOOSE	0.0250	0.0707	8
K	348.8571	144.0595	7	MISBIRD	0.0500	0.1414	8
CA	5952.2857	241.6442	7	BRYOCOV	73.5000	13.3417	8
MG	181.2857	96.5586	7	FLICCOV	6.1250	4.5806	8
MOISREG	2.5000	0.5345	8	CLICCOV	0.6250	0.7440	8
SNOWREG	3.0000	0.0000	8	ERECDED	19.6250	7.4821	8
CRYOREG	1.6250	0.5175	8	PROSDED	41.7500	13.6356	8
HUMMOCK	2.0000	0.0000	8				

STAND TYPE U4
NUMBER OF PLOTS 5
PLOT NUMBERS 030A 030B 0303 1409 1514

SAND	14.3500	12.0915	2	SLOPE	0.0000	0.0000	5
SILT	65.2500	6.4347	2	THAW77	31.0000	9.6695	5
CLAY	20.4000	5.6569	2	H2ODPTH	0.0000	0.0000	5
HYGMOIS	5.0000	2.2237	5	SOILCOV	0.4000	0.5477	5
ORGMAT	30.7000	14.1501	5	ROCKCOV	0.0000	0.0000	5
H2OABSN	177.0800	65.0307	5	H2OCOV	0.0000	0.0000	5
FLDCAP	75.2000	27.2765	5	MARL	0.0000	0.0000	5
WILTPT	55.5400	25.1145	5	BEAR	0.0000	0.0000	3
AVH2O	19.6600	9.8167	5	FOX	0.0000	0.0000	3
BDENS77	0.5340	0.2158	5	CARFECE	0.0667	0.0577	3
SMOIS77	116.6000	43.6383	5	CARGRAZ	0.1333	0.1155	3
PH	7.1160	0.5521	5	SQRRL	0.0000	0.0000	3
NH4	11.5600	2.7144	5	BRWNLEM	0.1333	0.2309	3
NO3	12.4000	4.1551	5	COLLEM	0.0000	0.0000	3
CO3	11.0200	11.1878	5	PTARMIG	0.0000	0.0000	3
P	6.6000	4.9295	5	GOOSE	0.0000	0.0000	3
K	269.8000	203.9024	5	MISBIRD	0.0333	0.0577	3
CA	6179.6000	1692.9989	5	BRYOCOV	65.8000	20.5840	5
MG	302.0000	227.6060	5	FLICCOV	1.0000	0.7071	5
MOISREG	3.0000	0.0000	5	CLICCOV	0.4000	0.5477	5
SNOWREG	3.0000	0.0000	5	ERECDED	27.8000	7.8549	5
CRYOREG	1.1000	0.5177	5	PROSDED	29.4000	13.3716	5
HUMMOCK	2.0000	0.0000	5				

Table C1 (cont'd).

STAND TYPE U6
NUMBER OF PLOTS 3
PLOT NUMBERS 0901 1416 1509

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	23.2000	0.0000	1	SLOPE	3.0000	0.0000	3
SILT	61.0000	0.0000	1	THAW77	60.6667	34.7755	3
CLAY	15.8000	0.0000	1	H2ODPTH	0.0000	0.0000	3
HYGMOIS	4.2333	3.2929	3	SOILCOV	3.6667	2.3094	3
ORGMAT	21.9000	14.7959	3	ROCKCOV	0.3333	0.5774	3
H2OABSN	115.7667	34.7657	3	H2OCOV	0.0000	0.0000	3
FLDCAP	47.6667	24.8041	3	MARL	0.0000	0.0000	3
WILTPT	34.5667	18.7257	3	BEAR	0.0000	0.0000	3
AVH2O	13.1000	7.2173	3	FOX	0.0667	0.1155	3
BDENS77	0.6800	0.2088	3	CARFECE	0.1667	0.2082	3
SMOIS77	62.0000	38.2230	3	CARGRAZ	0.0000	0.0000	3
PH	7.2900	0.3629	3	SORRL	0.0000	0.0000	3
NH4	11.2333	2.9838	3	BRWNLEM	0.0000	0.0000	3
NO3	13.1333	5.1695	3	COLLEM	0.3000	0.3464	3
CO3	14.6667	12.3824	3	PTARMIG	0.0000	0.0000	3
P	9.6667	6.5064	3	GOOSE	0.0000	0.0000	3
K	316.6667	87.1799	3	MISBIRD	0.1000	0.1732	3
CA	6356.6667	2054.0955	3	BRYOCOV	17.3333	8.7369	3
MG	289.0000	191.2041	3	FLICCOV	7.0000	9.5394	3
MOISREG	1.6667	0.5774	3	CLICCOV	3.6667	3.5119	3
SNOWREG	5.0000	0.0000	3	ERECDED	15.6667	4.0415	3
CRYOREG	2.3333	0.5774	3	PROSDED	26.6667	11.5470	3
HUMMOCK	4.0000	0.0000	3				

STAND TYPE U7
NUMBER OF PLOTS 2
PLOT NUMBERS 0902 1417

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	17.2000	0.0000	1	SLOPE	1.0000	0.0000	2
SILT	66.6000	0.0000	1	THAW77	32.0000	7.0711	2
CLAY	16.2000	0.0000	1	H2ODPTH	0.0000	0.0000	2
HYGMOIS	3.6000	1.6971	2	SOILCOV	0.5000	0.7071	2
ORGMAT	13.4500	5.4447	2	ROCKCOV	0.0000	0.0000	2
H2OABSN	111.0500	3.6062	2	H2OCOV	0.0000	0.0000	2
FLDCAP	48.6500	8.4146	2	MARL	0.0000	0.0000	2
WILTPT	28.5500	0.3536	2	BEAR	0.0000	0.0000	2
AVH2O	20.1000	8.0610	2	FOX	0.0500	0.0707	2
BDENS77	0.6400	0.0707	2	CARFECE	0.1000	0.1414	2
SMOIS77	65.0000	14.1421	2	CARGRAZ	0.0000	0.0000	2
PH	7.5700	0.0566	2	SORRL	0.0000	0.0000	2
NH4	9.4500	1.7678	2	BRWNLEM	0.0000	0.0000	2
NO3	12.1000	6.3640	2	COLLEM	0.4500	0.4950	2
CO3	14.9500	7.0004	2	PTARMIG	0.0000	0.0000	2
P	14.5000	2.1213	2	GOOSE	0.0000	0.0000	2
K	283.0000	121.6224	2	MISBIRD	0.0000	0.0000	2
CA	6495.0000	1548.5639	2	BRYOCOV	77.5000	10.6066	2
MG	182.5000	57.2756	2	FLICCOV	1.0000	1.4142	2
MOISREG	1.5000	0.7071	2	CLICCOV	0.0000	0.0000	2
SNOWREG	5.0000	0.0000	2	ERECDED	2.5000	2.1213	2
CRYOREG	1.0000	0.0000	2	PROSDED	21.0000	1.4142	2
HUMMOCK	2.0000	1.4142	2				

STAND TYPE U8
NUMBER OF PLOTS 1
PLOT NUMBERS 1103

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	33.4000	0.0000	1	SLOPE	0.0000	0.0000	1
SILT	51.8000	0.0000	1	THAW77	50.0000	0.0000	1
CLAY	14.8000	0.0000	1	H2ODPTH	0.0000	0.0000	1
HYGMOIS	1.5000	0.0000	1	SOILCOV	1.0000	0.0000	1
ORGMAT	8.0000	0.0000	1	ROCKCOV	0.0000	0.0000	1
H2OABSN	70.9000	0.0000	1	H2OCOV	0.0000	0.0000	1
FLDCAP	23.1000	0.0000	1	MARL	0.0000	0.0000	1
WILTPT	14.6000	0.0000	1	BEAR	0.0000	0.0000	1
AVH2O	8.5000	0.0000	1	FOX	0.0000	0.0000	1
BDENS77	0.8600	0.0000	1	CARFECE	0.0000	0.0000	1
SMOIS77	52.0000	0.0000	1	CARGRAZ	0.0000	0.0000	1
PH	7.6000	0.0000	1	SORRL	0.0000	0.0000	1
NH4	15.9000	0.0000	1	BRWNLEM	0.0000	0.0000	1
NO3	5.1000	0.0000	1	COLLEM	0.0000	0.0000	1
CO3	3.1000	0.0000	1	PTARMIG	0.1000	0.0000	1
P	0.1000	0.0000	1	GOOSE	0.0000	0.0000	1
K	36.0000	0.0000	1	MISBIRD	0.0000	0.0000	1
CA	1843.0000	0.0000	1	BRYOCOV	25.0000	0.0000	1
MG	86.0000	0.0000	1	FLICCOV	0.0000	0.0000	1
MOISREG	3.0000	0.0000	1	CLICCOV	0.0000	0.0000	1
SNOWREG	3.0000	0.0000	1	ERECDED	30.0000	0.0000	1
CRYOREG	1.0000	0.0000	1	PROSDED	60.0000	0.0000	1
HUMMOCK	1.0000	0.0000	1				

Table C1 (cont'd). Environmental data summaries for all stand types. The variables and their units are described in Table 6.

STAND TYPE U9
NUMBER OF PLOTS 1
PLOT NUMBERS 1102

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	9.1000	0.0000	1	SLOPE	2.0000	0.0000	1
SILT	65.4000	0.0000	1	THAW77	33.0000	0.0000	1
CLAY	25.5000	0.0000	1	H2ODPTH	0.0000	0.0000	1
HYGMOIS	3.2000	0.0000	1	SOILCOV	0.0000	0.0000	1
ORGMAT	19.1000	0.0000	1	ROCKCOV	0.0000	0.0000	1
H2OABSN	122.7000	0.0000	1	H2OCOV	0.0000	0.0000	1
FLDCAP	48.7000	0.0000	1	MARL	0.0000	0.0000	1
WILTPT	32.9000	0.0000	1	BEAR	0.0000	0.0000	1
AVH2O	15.8000	0.0000	1	FOX	0.0000	0.0000	1
BDENS77	0.6700	0.0000	1	CARFECE	0.1000	0.0000	1
SMOIS77	62.0000	0.0000	1	CARGRAZ	0.2000	0.0000	1
PH	7.5900	0.0000	1	SQRRL	0.0000	0.0000	1
NH4	22.2000	0.0000	1	BRWNLEM	0.0000	0.0000	1
NO3	10.2000	0.0000	1	COLLEM	0.0000	0.0000	1
CO3	14.7000	0.0000	1	PTARMIG	0.0000	0.0000	1
P	23.0000	0.0000	1	GOOSE	0.0000	0.0000	1
K	341.0000	0.0000	1	MISBIRD	0.1000	0.0000	1
CA	6105.0000	0.0000	1	BRYOCOV	94.0000	0.0000	1
MG	179.0000	0.0000	1	FLICCOV	0.0000	0.0000	1
MOISREG	2.0000	0.0000	1	CLICCOV	0.0000	0.0000	1
SNOWREG	4.0000	0.0000	1	ERECDED	6.0000	0.0000	1
CRYOREG	2.0000	0.0000	1	PROSDED	11.0000	0.0000	1
HUMMOCK	2.0000	0.0000	1				

STAND TYPE U10
NUMBER OF PLOTS 4
PLOT NUMBERS 1002 1418 1422 1502

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	51.8000	0.0000	1	SLOPE	1.0000	1.1547	4
SILT	30.9000	0.0000	1	THAW77	49.3333	20.5020	3
CLAY	17.3000	0.0000	1	H2ODPTH	0.0000	0.0000	3
HYGMOIS	6.1000	2.3431	3	SOILCOV	2.0000	2.7080	4
ORGMAT	35.5333	12.0338	3	ROCKCOV	1.5000	2.3805	4
H2OABSN	161.7000	20.9115	3	H2OCOV	0.0000	0.0000	4
FLDCAP	68.9333	17.0254	3	MARL	0.0000	0.0000	4
WILTPT	52.6000	14.7102	3	BEAR	0.0250	0.0500	4
AVH2O	16.3333	9.2576	3	FOX	0.0250	0.0500	4
BDENS77	0.4633	0.1210	3	CARFECE	0.0250	0.0500	4
SMOIS77	76.3333	54.0494	3	CARGRAZ	0.0000	0.0000	4
PH	7.1200	0.5147	3	SQRRL	0.0750	0.0500	4
NH4	16.0000	3.7242	3	BRWNLEM	0.0000	0.0000	4
NO3	15.4000	5.2574	3	COLLEM	0.0000	0.0000	4
CO3	8.0000	10.5825	3	PTARMIG	0.0500	0.0577	4
P	15.0000	9.5394	3	GOOSE	0.0000	0.0000	4
K	233.3333	90.4673	3	MISBIRD	0.1000	0.0000	4
CA	7421.3333	2250.5413	3	BRYOCOV	21.5000	29.5917	4
MG	517.0000	306.2564	3	FLICCOV	1.0000	0.0000	4
MOISREG	2.2500	0.5000	4	CLICCOV	0.7500	0.9574	4
SNOWREG	2.0000	0.0000	4	ERECDED	25.0000	17.3205	4
CRYOREG	1.0000	0.0000	4	PROSDED	12.5000	6.4550	4
HUMMOCK	2.7500	1.5000	4				

STAND TYPE U12
NUMBER OF PLOTS 2
PLOT NUMBERS 1303 1311

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	51.4000	64.3467	2	SLOPE	0.0000	0.0000	2
SILT	16.4000	20.3647	2	THAW77	15.0000	5.6569	2
CLAY	32.2000	43.9820	2	H2ODPTH	0.0000	0.0000	2
HYGMOIS	6.3500	0.9192	2	SOILCOV	1.0000	1.4142	2
ORGMAT	53.3500	19.0212	2	ROCKCOV	0.0000	0.0000	2
H2OABSN	140.7500	37.4059	2	H2OCOV	0.0000	0.0000	2
FLDCAP	86.0500	12.7986	2	MARL	0.0000	0.0000	2
WILTPT	55.3000	31.5370	2	BEAR	0.0000	0.0000	1
AVH2O	30.7500	18.7383	2	FOX	0.0000	0.0000	1
BDENS77	0.7750	0.6152	2	CARFECE	0.1000	0.0000	1
SMOIS77	90.5000	95.4594	2	CARGRAZ	0.0000	0.0000	1
PH	5.1400	0.0566	2	SQRRL	0.0000	0.0000	1
NH4	19.4000	0.0000	1	BRWNLEM	0.0000	0.0000	1
NO3	9.2000	0.0000	1	COLLEM	0.0000	0.0000	1
CO3	0.0500	0.0707	2	PTARMIG	0.0000	0.0000	1
P	2.0000	0.0000	1	GOOSE	0.0000	0.0000	1
K	389.0000	0.0000	1	MISBIRD	0.0000	0.0000	1
CA	2558.0000	0.0000	1	BRYOCOV	25.0000	21.2132	2
MG	638.0000	0.0000	1	FLICCOV	1.0000	0.0000	2
MOISREG	3.0000	0.0000	2	CLICCOV	1.0000	0.0000	2
SNOWREG	3.0000	0.0000	2	ERECDED	45.0000	7.0711	2
CRYOREG	2.0000	0.0000	2	PROSDED	30.0000	0.0000	2
HUMMOCK	2.0000	0.0000	2				

Table C1 (cont'd).

STAND TYPE U13
NUMBER OF PLOTS 1
PLOT NUMBERS 1309

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	67.4000	0.0000	1	SLOPE	0.0000	0.0000	1
SILT	22.9000	0.0000	1	THAW77	56.0000	0.0000	1
CLAY	9.7000	0.0000	1	H2ODPTH	0.0000	0.0000	1
HYGMOIS	4.4000	0.0000	1	SOILCOV	50.0000	0.0000	1
ORGMAT	43.8000	0.0000	1	ROCKCOV	0.0000	0.0000	1
H2OABSN	0.0000	0.0000	0	H2OCOV	0.0000	0.0000	1
FLDCAP	0.0000	0.0000	0	MARL	0.0000	0.0000	1
WILTPT	0.0000	0.0000	0	BEAR	0.0000	0.0000	1
AVH2O	0.0000	0.0000	0	FOX	0.0000	0.0000	1
BDENS77	0.3500	0.0000	1	CARFECE	0.0000	0.0000	1
SMOIS77	176.0000	0.0000	1	CARGRAZ	0.0000	0.0000	1
PH	7.5000	0.0000	1	SQRRL	0.0000	0.0000	1
NH4	0.0000	0.0000	0	BRWNLEM	0.0000	0.0000	1
NO3	0.0000	0.0000	0	COLLEM	0.0000	0.0000	1
CO3	3.6000	0.0000	1	PTARMIG	0.0000	0.0000	1
P	0.0000	0.0000	0	GOOSE	0.1000	0.0000	1
K	0.0000	0.0000	0	MISBIRD	0.0000	0.0000	1
CA	0.0000	0.0000	0	BRYOCOV	0.0000	0.0000	1
MG	0.0000	0.0000	0	FLICCOV	0.0000	0.0000	1
MOISREG	3.0000	0.0000	1	CLICCOV	0.0000	0.0000	1
SNOWREG	3.0000	0.0000	1	ERECDED	60.0000	0.0000	1
CRYOREG	3.0000	0.0000	1	PROSDED	60.0000	0.0000	1
HUMMOCK	2.0000	0.0000	1				

STAND TYPE U14
NUMBER OF PLOTS 2
PLOT NUMBERS 1204 1210

SAND	40.7000	0.1414	2	SLOPE	0.0000	0.0000	2
SILT	49.2500	0.6364	2	THAW77	61.5000	6.3640	2
CLAY	10.0500	0.7778	2	H2ODPTH	0.0000	0.0000	2
HYGMOIS	0.7500	0.0707	2	SOILCOV	57.5000	3.5355	2
ORGMAT	4.7500	0.4950	2	ROCKCOV	0.0000	0.0000	2
H2OABSN	52.2000	0.0000	1	H2OCOV	0.0000	0.0000	2
FLDCAP	12.4000	0.0000	1	MARL	0.0000	0.0000	2
WILTPT	7.6000	0.0000	1	BEAR	0.0000	0.0000	2
AVH2O	4.8000	0.0000	1	FOX	0.0500	0.0707	2
BDENS77	0.9550	0.0354	2	CARFECE	0.0500	0.0707	2
SMOIS77	27.5000	3.5355	2	CARGRAZ	0.0000	0.0000	2
PH	7.9000	0.0000	2	SQRRL	0.0000	0.0000	2
NH4	16.1000	0.0000	1	BRWNLEM	0.0000	0.0000	2
NO3	5.3000	0.0000	1	COLLEM	0.0000	0.0000	2
CO3	29.8500	4.4548	2	PTARMIG	0.0000	0.0000	2
P	1.0000	0.0000	1	GOOSE	0.1000	0.1414	2
K	70.0000	0.0000	1	MISBIRD	0.0000	0.0000	2
CA	1327.0000	0.0000	1	BRYOCOV	0.5000	0.7071	2
MG	196.0000	0.0000	1	FLICCOV	0.0000	0.0000	2
MOISREG	2.0000	0.0000	2	CLICCOV	0.0000	0.0000	2
SNOWREG	2.0000	0.0000	2	ERECDED	15.0000	7.0711	2
CRYOREG	1.0000	0.0000	2	PROSDED	10.0000	7.0711	2
HUMMOCK	2.0000	0.0000	2				

STAND TYPE M1
NUMBER OF PLOTS 4
PLOT NUMBERS 1404 1407 1414 1420

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	26.0000	16.9706	2	SLOPE	0.0000	0.0000	4
SILT	56.3500	10.6773	2	THAW77	27.5000	1.0000	4
CLAY	17.6500	6.2933	2	H2ODPTH	0.0000	0.0000	4
HYGMOIS	7.8250	1.4361	4	SOILCOV	36.0000	26.2805	4
ORGMAT	56.9500	9.7257	4	ROCKCOV	0.0000	0.0000	4
H2OABSN	288.3250	61.8651	4	H2OCOV	0.0000	0.0000	4
FLDCAP	109.5500	11.5046	4	MARL	0.0000	0.0000	4
WILTPT	69.0750	12.4350	4	BEAR	0.0000	0.0000	3
AVH2O	20.4750	3.4817	4	FOX	0.0000	0.0000	3
BDENS77	0.2225	0.0050	4	CARFECE	0.0333	0.0577	3
SMOIS77	311.5000	34.4915	4	CARGRAZ	0.0000	0.0000	3
PH	5.7700	0.4764	4	SQRRL	0.0000	0.0000	3
NH4	13.3500	2.2113	4	BRWNLEM	0.0000	0.0000	3
NO3	12.4000	1.5706	4	COLLEM	0.0000	0.0000	3
CO3	0.5250	0.5679	4	PTARMIG	0.0000	0.0000	3
P	2.2500	0.5000	4	GOOSE	0.0000	0.0000	3
K	212.2500	38.1696	4	MISBIRD	0.2000	0.2000	3
CA	5169.5000	581.3390	4	BRYOCOV	30.2500	9.1788	4
MG	296.5000	45.9964	4	FLICCOV	0.0000	0.0000	4
MOISREG	4.0000	0.0000	4	CLICCOV	0.0000	0.0000	4
SNOWREG	3.0000	0.0000	4	ERECDED	17.2500	2.6300	4
CRYOREG	1.0000	0.0000	4	PROSDED	15.7500	7.1356	4
HUMMOCK	1.2500	0.5000	4				

Table C1 (cont'd). Environmental data summaries for all stand types. The variables and their units are described in Table 6.

STAND TYPE M2
NUMBER OF PLOTS 8
PLOT NUMBERS 040A 040B 1304 1308 1501 1503 1511 1516

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	32.2000	29.6341	7	SLOPE	0.0000	0.0000	8
SILT	49.8000	27.2904	7	THAW77	31.1250	6.5778	8
CLAY	18.0000	8.6741	7	H2ODPTH	0.3750	1.0607	8
HYGMOIS	5.8500	2.6328	8	SOILCOV	7.7500	9.9604	8
ORGMAT	38.4500	20.4306	8	ROCKCOV	0.0000	0.0000	8
H2OABSN	228.0375	99.9905	8	H2OCOV	1.5000	2.5071	8
FLDCAP	78.5125	34.1701	8	MARL	29.5000	19.4789	8
WILTPT	65.1875	32.1475	8	BEAR	0.0000	0.0000	8
AVH2O	13.3250	5.4300	8	FOX	0.0000	0.0000	8
BDENS77	0.3300	0.1195	8	CARFECE	0.0000	0.0000	8
SMOIS77	231.3750	147.3382	8	CARGRAZ	0.1625	0.1506	8
PH	7.0075	0.8148	8	SQRRL	0.0000	0.0000	8
NH4	15.8500	9.5226	8	BRWNLEM	0.0125	0.0354	8
NO3	12.8875	3.1975	8	COLLEM	0.0250	0.0707	8
CO3	11.6500	10.0798	8	PTARMIG	0.0125	0.0354	8
P	9.6250	4.8679	8	GOOSE	0.0000	0.0000	8
K	395.8750	122.4412	8	MISBIRD	0.0125	0.0354	8
CA	6228.6250	1573.0095	8	BRYOCOV	63.5000	39.4136	8
MG	391.6250	403.8797	8	FLICCOV	0.0000	0.0000	8
MOISREG	3.8750	0.3536	8	CLICCOV	0.0000	0.0000	8
SNOWREG	3.0000	0.0000	8	ERECDED	21.5000	13.9489	8
CRYOREG	1.0000	0.0000	8	PROSDED	19.5000	14.8324	8
HUMMOCK	1.3750	0.5175	8				

STAND TYPE M3
NUMBER OF PLOTS 2
PLOT NUMBERS 1203 1205

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	32.8000	0.0000	1	SLOPE	0.0000	0.0000	2
SILT	53.7000	0.0000	1	THAW77	25.0000	8.4853	2
CLAY	13.5000	0.0000	1	H2ODPTH	0.0000	0.0000	2
HYGMOIS	1.7000	0.2828	2	SOILCOV	0.0000	0.0000	2
ORGMAT	14.0000	5.7983	2	ROCKCOV	0.0000	0.0000	2
H2OABSN	141.3000	43.9820	2	H2OCOV	0.0000	0.0000	2
FLDCAP	37.1000	22.7688	2	MARL	5.0000	0.0000	2
WILTPT	27.3500	14.4957	2	BEAR	0.0000	0.0000	2
AVH2O	9.7500	8.2731	2	FOX	0.0000	0.0000	2
BDENS77	0.7250	0.2333	2	CARFECE	0.0000	0.0000	2
SMOIS77	71.0000	28.2843	2	CARGRAZ	0.0000	0.0000	2
PH	7.5000	0.1414	2	SQRRL	0.0000	0.0000	2
NH4	21.3500	2.4749	2	BRWNLEM	0.0000	0.0000	2
NO3	6.5000	0.9899	2	COLLEM	0.0000	0.0000	2
CO3	23.0000	1.4142	2	PTARMIG	0.0000	0.0000	2
P	8.5000	2.1213	2	GOOSE	0.4000	0.5657	2
K	49.0000	2.8284	2	MISBIRD	0.0000	0.0000	2
CA	1796.0000	161.2203	2	BRYOCOV	97.5000	3.5355	2
MG	90.0000	39.5980	2	FLICCOV	0.0000	0.0000	2
MOISREG	4.0000	0.0000	2	CLICCOV	0.0000	0.0000	2
SNOWREG	3.0000	0.0000	2	ERECDED	27.5000	17.6777	2
CRYOREG	1.0000	0.0000	2	PROSDED	15.0000	14.1421	2
HUMMOCK	1.5000	0.7071	2				

STAND TYPE M4
NUMBER OF PLOTS 4
PLOT NUMBERS 050A 050B 1413 1517

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	6.2000	0.0000	2	SLOPE	0.0000	0.0000	4
SILT	73.3000	3.5355	2	THAW77	32.5000	3.0000	4
CLAY	20.5000	3.5355	2	H2ODPTH	2.2500	2.8723	4
HYGMOIS	5.1500	2.3700	4	SOILCOV	29.5000	28.9540	4
ORGMAT	38.9250	17.2283	4	ROCKCOV	0.0000	0.0000	4
H2OABSN	249.8750	68.5028	4	H2OCOV	27.0000	24.5628	4
FLDCAP	67.3500	34.4613	4	MARL	45.5000	34.7803	4
WILTPT	76.5250	33.9968	4	BEAR	0.0000	0.0000	4
AVH2O	8.8750	4.9040	4	FOX	0.0000	0.0000	4
BDENS77	0.2400	0.1802	4	CARFECE	0.0000	0.0000	4
SMOIS77	349.2500	162.7193	4	CARGRAZ	0.0000	0.0000	4
PH	6.9475	0.8448	4	SQRRL	0.0000	0.0000	4
NH4	21.1333	12.5835	3	BRWNLEM	0.0000	0.0000	4
NO3	16.4333	3.9017	3	COLLEM	0.0000	0.0000	4
CO3	12.6250	10.8954	4	PTARMIG	0.0000	0.0000	4
P	9.0000	5.0000	3	GOOSE	0.0250	0.0500	4
K	287.3333	179.7229	3	MISBIRD	0.0000	0.0000	4
CA	5229.3333	427.2392	3	BRYOCOV	26.2500	26.0560	4
MG	258.6667	170.2948	3	FLICCOV	0.0000	0.0000	4
MOISREG	4.5000	0.5774	4	CLICCOV	0.0000	0.0000	4
SNOWREG	3.0000	0.0000	4	ERECDED	21.0000	11.1654	4
CRYOREG	1.0000	0.0000	4	PROSDED	9.2500	5.7373	4
HUMMOCK	1.0000	0.0000	4				

Table C1 (cont'd).

STAND TYPE M5
NUMBER OF PLOTS 2
PLOT NUMBERS 1101 1508

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	52.2000	0.0000	1	SLOPE	0.0000	0.0000	2
SILT	32.6000	0.0000	1	THAW77	48.5000	10.6066	2
CLAY	15.2000	0.0000	1	H2ODPTH	0.0000	0.0000	2
HYGMOIS	0.9000	0.7071	2	SOILCOV	11.5000	3.5355	2
ORGMAT	5.7500	4.8790	2	ROCKCOV	0.0000	0.0000	2
H2OABSN	64.1000	38.6080	2	H2OCOV	0.0000	0.0000	2
FLDCAP	14.8500	12.6572	2	MARL	0.0000	0.0000	2
WILTPT	11.2000	10.7480	2	BEAR	0.0000	0.0000	2
AVH2O	3.6500	1.9092	2	FOX	0.0000	0.0000	2
BDENS77	0.6800	0.1838	2	CARFECE	0.0000	0.0000	2
SMOIS77	54.5000	23.3345	2	CARGRAZ	0.3000	0.4243	2
PH	7.7200	0.1556	2	SQRRL	0.0000	0.0000	2
NH4	10.8000	5.9397	2	BRWNLEM	0.0000	0.0000	2
NO3	9.0500	2.1920	2	COLLEM	0.0000	0.0000	2
CO3	14.3000	0.5657	2	PTARMIG	0.0000	0.0000	2
P	11.5000	3.5355	2	GOOSE	0.0000	0.0000	2
K	546.0000	22.6274	2	MISBIRD	0.0500	0.0707	2
CA	3228.5000	771.4535	2	BRYOCOV	25.5000	2.1213	2
MG	54.5000	14.8492	2	FLICCOV	0.0000	0.0000	2
MOISREG	2.5000	0.7071	2	CLICCOV	0.0000	0.0000	2
SNOWREG	5.0000	0.0000	2	ERECDED	14.5000	2.1213	2
CRYOREG	1.0000	0.0000	2	PROSDED	26.0000	29.6985	2
HUMMOCK	1.0000	0.0000	2				

STAND TYPE M7
NUMBER OF PLOTS 1
PLOT NUMBERS 1107

SAND	44.4000	0.0000	1	SLOPE	0.0000	0.0000	1
SILT	41.6000	0.0000	1	THAW77	63.0000	0.0000	1
CLAY	14.0000	0.0000	1	H2ODPTH	0.0000	0.0000	1
HYGMOIS	1.5000	0.0000	1	SOILCOV	2.0000	0.0000	1
ORGMAT	7.1000	0.0000	1	ROCKCOV	0.0000	0.0000	1
H2OABSN	65.0000	0.0000	1	H2OCOV	0.0000	0.0000	1
FLDCAP	20.9000	0.0000	1	MARL	0.0000	0.0000	1
WILTPT	12.2000	0.0000	1	BEAR	0.0000	0.0000	0
AVH2O	8.7000	0.0000	1	FOX	0.0000	0.0000	0
BDENS77	0.9100	0.0000	1	CARFECE	0.0000	0.0000	0
SMOIS77	49.0000	0.0000	1	CARGRAZ	0.0000	0.0000	0
PH	7.7000	0.0000	1	SQRRL	0.0000	0.0000	0
NH4	17.5000	0.0000	1	BRWNLEM	0.0000	0.0000	0
NO3	4.5000	0.0000	1	COLLEM	0.0000	0.0000	0
CO3	4.6000	0.0000	1	PTARMIG	0.0000	0.0000	0
P	0.1000	0.0000	1	GOOSE	0.0000	0.0000	0
K	36.0000	0.0000	1	MISBIRD	0.0000	0.0000	0
CA	1377.0000	0.0000	1	BRYOCOV	1.0000	0.0000	1
MG	123.0000	0.0000	1	FLICCOV	0.0000	0.0000	1
MOISREG	2.0000	0.0000	1	CLICCOV	0.0000	0.0000	1
SNOWREG	3.0000	0.0000	1	ERECDED	20.0000	0.0000	1
CRYOREG	1.0000	0.0000	1	PROSDED	5.0000	0.0000	1
HUMMOCK	1.0000	0.0000	1				

STAND TYPE M8
NUMBER OF PLOTS 1
PLOT NUMBERS 1306

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	26.3000	0.0000	1	SLOPE	0.0000	0.0000	1
SILT	25.5000	0.0000	1	THAW77	22.0000	0.0000	1
CLAY	48.2000	0.0000	1	H2ODPTH	0.0000	0.0000	1
HYGMOIS	7.8000	0.0000	1	SOILCOV	1.0000	0.0000	1
ORGMAT	43.1000	0.0000	1	ROCKCOV	0.0000	0.0000	1
H2OABSN	204.0000	0.0000	1	H2OCOV	0.0000	0.0000	1
FLDCAP	93.6000	0.0000	1	MARL	0.0000	0.0000	1
WILTPT	57.5000	0.0000	1	BEAR	0.0000	0.0000	1
AVH2O	36.1000	0.0000	1	FOX	0.0000	0.0000	1
BDENS77	0.3500	0.0000	1	CARFECE	0.0000	0.0000	1
SMOIS77	202.0000	0.0000	1	CARGRAZ	0.0000	0.0000	1
PH	5.8500	0.0000	1	SQRRL	0.0000	0.0000	1
NH4	15.0000	0.0000	1	BRWNLEM	0.1000	0.0000	1
NO3	9.7000	0.0000	1	COLLEM	0.0000	0.0000	1
CO3	0.6000	0.0000	1	PTARMIG	0.0000	0.0000	1
P	1.0000	0.0000	1	GOOSE	0.0000	0.0000	1
K	356.0000	0.0000	1	MISBIRD	0.0000	0.0000	1
CA	6616.0000	0.0000	1	BRYOCOV	20.0000	0.0000	1
MG	845.0000	0.0000	1	FLICCOV	0.0000	0.0000	1
MOISREG	4.0000	0.0000	1	CLICCOV	0.0000	0.0000	1
SNOWREG	3.0000	0.0000	1	ERECDED	40.0000	0.0000	1
CRYOREG	1.0000	0.0000	1	PROSDED	50.0000	0.0000	1
HUMMOCK	1.0000	0.0000	1				

Table C1 (cont'd). Environmental data summaries for all stand types.
The variables and their units are described in Table 6.

STAND TYPE M9
NUMBER OF PLOTS 2
PLOT NUMBERS 1302 1318

SAND	59.4500	22 9810	2	SLOPE	0.0000	0.0000	2
SILT	28.6000	21.3546	2	THAW77	43.0000	11.3137	2
CLAY	11.9500	1.6263	2	H2ODPTH	0.0000	0.0000	2
HYGMOIS	2.0500	1.7678	2	SOILCOV	7.5000	3.5355	2
ORGMAT	23.0500	23.1224	2	ROCKCOV	0.0000	0.0000	2
H2OABSN	69.7000	0.0000	1	H2OCOV	2.5000	3.5355	2
FLDCAP	17.9000	0.0000	1	MARL	0.0000	0.0000	2
WILTPT	12 6000	0.0000	1	BEAR	0.0000	0.0000	2
AVH2O	5.3000	0.0000	1	FOX	0.0000	0.0000	2
BDENS77	0.7000	0.4101	2	CARFECE	0.0500	0.0707	2
SMOIS77	100.0000	73 5391	2	CARGRAZ	0.0000	0.0000	2
PH	7 0500	0.6364	2	SQRRL	0.0000	0.0000	2
NH4	18 3000	0.0000	1	BRWNLEM	0 0000	0.0000	2
NO3	5.0000	0.0000	1	COLLEM	0.0000	0.0000	2
CO3	12 3500	17.4655	2	PTARMIG	0.0500	0.0707	2
P	0.1000	0.0000	1	GOOSE	0.5000	0.5657	2
K	92.0000	0.0000	1	MISBIRD	0 0000	0.0000	2
CA	1399 0000	0.0000	1	BRYOCOV	0.5000	0.7071	2
MG	266.0000	0.0000	1	FLICCOV	0.0000	0.0000	2
MOISREG	4.5000	0.7071	2	CLICCOV	0.0000	0.0000	2
SNOWREG	4 0000	1.4142	2	ERECDED	30 0000	28.2843	2
CRYOREG	1.0000	0.0000	2	PROSDED	7.5000	3.5355	2
HUMMOCK	1.0000	0.0000	2				

STAND TYPE M10
NUMBER OF PLOTS 1
PLOT NUMBERS 1310

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	94.2000	0.0000	1	SLOPE	0.0000	0.0000	1
SILT	3.6000	0.0000	1	THAW77	21.0000	0.0000	1
CLAY	2.2000	0.0000	1	H2ODPTH	0.0000	0.0000	1
HYGMOIS	6.6000	0.0000	1	SOILCOV	10.0000	0.0000	1
ORGMAT	62.3000	0.0000	1	ROCKCOV	0.0000	0.0000	1
H2OABSN	309.5000	0.0000	1	H2OCOV	1.0000	0.0000	1
FLDCAP	111.9000	0.0000	1	MARL	0.0000	0.0000	1
WILTPT	88.3000	0.0000	1	BEAR	0.0000	0.0000	1
AVH2O	23.6000	0.0000	1	FOX	0.0000	0.0000	1
BDENS77	0.2400	0.0000	1	CARFECE	0.0000	0.0000	1
SMOIS77	290.0000	0.0000	1	CARGRAZ	0.0000	0.0000	1
PH	5.2000	0.0000	1	SQRRL	0.0000	0.0000	1
NH4	0.0000	0.0000	0	BRWNLEM	0.0000	0.0000	1
NO3	0.0000	0.0000	0	COLLEM	0.0000	0.0000	1
CO3	0.0000	0.0000	1	PTARMIG	0.0000	0.0000	1
P	0.0000	0.0000	0	GOOSE	0.0000	0.0000	1
K	0.0000	0.0000	0	MISBIRD	0.0000	0.0000	1
CA	0.0000	0.0000	0	BRYOCOV	5.0000	0.0000	1
MG	0 0000	0.0000	0	FLICCOV	0.0000	0.0000	1
MOISREG	4.0000	0.0000	1	CLICCOV	1.0000	0.0000	1
SNOWREG	3 0000	0.0000	1	ERECDED	10.0000	0.0000	1
CRYOREG	1.0000	0.0000	1	PROSDED	40 0000	0.0000	1
HUMMOCK	2 0000	0.0000	1				

STAND TYPE M11
NUMBER OF PLOTS 1
PLOT NUMBERS 1209

SAND	79.7000	0.0000	1	SLOPE	0 0000	0.0000	1
SILT	14.0000	0.0000	1	THAW77	48.0000	0.0000	1
CLAY	6.3000	0.0000	1	H2ODPTH	0.0000	0.0000	1
HYGMOIS	0.3000	0.0000	1	SOILCOV	60.0000	0.0000	1
ORGMAT	3.0000	0.0000	1	ROCKCOV	0.0000	0.0000	1
H2OABSN	0 0000	0.0000	0	H2OCOV	0.0000	0 0000	1
FLDCAP	0 0000	0.0000	0	MARL	0.0000	0.0000	1
WILTPT	0.0000	0.0000	0	BEAR	0.0000	0 0000	1
AVH2O	0.0000	0.0000	0	FOX	0.0000	0.0000	1
BDENS77	0 8900	0.0000	1	CARFECE	0.0000	0.0000	1
SMOIS77	33.0000	0.0000	1	CARGRAZ	0.0000	0.0000	1
PH	8 1000	0.0000	1	SQRRL	0.2000	0 0000	1
NH4	0.0000	0.0000	0	BRWNLEM	0.0000	0.0000	1
NO3	0.0000	0.0000	0	COLLEM	0.0000	0 0000	1
CO3	26.4000	0.0000	1	PTARMIG	0.0000	0.0000	1
P	0.0000	0 0000	0	GOOSE	0.4000	0.0000	1
K	0 0000	0 0000	0	MISBIRD	0.0000	0.0000	1
CA	0 0000	0.0000	0	BRYOCOV	0.0000	0.0000	1
MG	0 0000	0.0000	0	FLICCOV	0.0000	0 0000	1
MOISREG	3 0000	0 0000	1	CLICCOV	0 0000	0 0000	1
SNOWREG	3 0000	0 0000	1	ERECDED	25 0000	0 0000	1
CRYOREG	1 0000	0 0000	1	PROSDED	15 0000	0 0000	1
HUMMOCK	1 0000	0.0000	1				

Table C1 (cont'd).

STAND TYPE E1
NUMBER OF PLOTS 3
PLOT NUMBERS 1402 1408 1518

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	0.0000	0.0000	0	SLOPE	0.0000	0.0000	3
SILT	0.0000	0.0000	0	THAW77	32.3333	1.1547	3
CLAY	0.0000	0.0000	0	H2ODPTH	6.6667	6.6583	3
HYGMOIS	7.0000	3.2604	3	SOILCOV	13.3333	23.0940	3
ORGMAT	46.2000	19.2486	3	ROCKCOV	0.0000	0.0000	3
H2OABSN	273.3667	93.7311	3	H2OCOV	62.3333	34.2685	3
FLDCAP	98.9667	27.7594	3	MARL	13.3333	23.0940	3
WILTPT	63.9667	23.1141	3	BEAR	0.0000	0.0000	3
AVH2O	35.0000	9.2968	3	FOX	0.0000	0.0000	3
BDENS77	0.2033	0.1286	3	CARFECE	0.0000	0.0000	3
SMOIS77	413.6667	219.0304	3	CARGRAZ	0.0000	0.0000	3
PH	6.5367	0.9341	3	SQRRL	0.0000	0.0000	3
NH4	12.3000	0.7071	2	BRWNLEM	0.0000	0.0000	3
NO3	9.0000	2.1213	2	COLLEM	0.0000	0.0000	3
CO3	10.3333	16.2531	3	PTARMIG	0.0333	0.0577	3
P	5.0000	6.9282	3	GOOSE	0.0000	0.0000	3
K	232.3333	66.7857	3	MISBIRD	0.3000	0.3000	3
CA	6791.6667	1064.0058	3	BRYOCOV	0.0000	0.0000	3
MG	388.6667	376.0855	3	FLICCOV	0.0000	0.0000	3
MOISREG	5.0000	0.0000	3	CLICCOV	0.0000	0.0000	3
SNOWREG	3.0000	0.0000	3	ERECDED	8.3333	5.7735	3
CRYOREG	1.0000	0.0000	3	PROSDED	43.6667	41.8609	3
HUMMOCK	1.0000	0.0000	3				

STAND TYPE E2
NUMBER OF PLOTS 3
PLOT NUMBERS 060A 060B 1307

SAND	20.1333	13.4834	3	SLOPE	0.0000	0.0000	3
SILT	40.5667	10.0719	3	THAW77	33.0000	8.1854	3
CLAY	39.3000	19.7274	3	H2ODPTH	31.6667	27.0617	3
HYGMOIS	5.1333	3.1723	3	SOILCOV	46.0000	18.5203	3
ORGMAT	35.9667	24.3599	3	ROCKCOV	0.0000	0.0000	3
H2OABSN	294.1333	289.5780	3	H2OCOV	69.0000	53.6936	3
FLDCAP	94.6333	68.1030	3	MARL	31.6667	50.5800	3
WILTPT	76.1000	70.7844	3	BEAR	0.0000	0.0000	3
AVH2O	18.5333	3.1723	3	FOX	0.0000	0.0000	3
BDENS77	0.3650	0.3465	2	CARFECE	0.0000	0.0000	3
SMOIS77	304.0000	308.2986	2	CARGRAZ	0.0000	0.0000	3
PH	7.0900	0.6938	3	SQRRL	0.0000	0.0000	3
NH4	25.5500	5.1619	2	BRWNLEM	0.0000	0.0000	3
NO3	8.6000	1.6971	2	COLLEM	0.0000	0.0000	3
CO3	10.4333	14.8210	3	PTARMIG	0.0000	0.0000	3
P	7.5000	4.9497	2	GOOSE	0.0000	0.0000	3
K	250.5000	297.6920	2	MISBIRD	0.0000	0.0000	3
CA	4600.5000	2749.9383	2	BRYOCOV	0.3333	0.5774	3
MG	231.0000	240.4163	2	FLICCOV	0.0000	0.0000	3
MOISREG	5.0000	0.0000	3	CLICCOV	0.0000	0.0000	3
SNOWREG	3.0000	0.0000	3	ERECDED	15.3333	9.6090	3
CRYOREG	1.0000	0.0000	3	PROSDED	42.3333	26.5769	3
HUMMOCK	1.0000	0.0000	3				

STAND TYPE E3
NUMBER OF PLOTS 1
PLOT NUMBERS 1206

VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N	VARIABLE	AVERAGE VALUE	STAND. DEVIATION	N
SAND	0.0000	0.0000	0	SLOPE	0.0000	0.0000	1
SILT	0.0000	0.0000	0	THAW77	34.0000	0.0000	1
CLAY	0.0000	0.0000	0	H2ODPTH	31.0000	0.0000	1
HYGMOIS	1.2000	0.0000	1	SOILCOV	0.0000	0.0000	1
ORGMAT	9.5000	0.0000	1	ROCKCOV	0.0000	0.0000	1
H2OABSN	92.5000	0.0000	1	H2OCOV	90.0000	0.0000	1
FLDCAP	20.1000	0.0000	1	MARL	60.0000	0.0000	1
WILTPT	16.5000	0.0000	1	BEAR	0.0000	0.0000	1
AVH2O	3.6000	0.0000	1	FOX	0.0000	0.0000	1
BDENS77	0.2400	0.0000	1	CARFECE	0.0000	0.0000	1
SMOIS77	247.0000	0.0000	1	CARGRAZ	0.0000	0.0000	1
PH	7.5000	0.0000	1	SQRRL	0.0000	0.0000	1
NH4	40.1000	0.0000	1	BRWNLEM	0.0000	0.0000	1
NO3	5.1000	0.0000	1	COLLEM	0.0000	0.0000	1
CO3	14.3000	0.0000	1	PTARMIG	0.0000	0.0000	1
P	2.0000	0.0000	1	GOOSE	0.0000	0.0000	1
K	[illegible]	0.0000	1	MISBIRD	0.0000	0.0000	1
CA	[illegible]	0.0000	1	BRYOCOV	100.0000	0.0000	1
MG	56.0000	0.0000	1	FLICCOV	0.0000	0.0000	1
MOISREG	5.0000	0.0000	1	CLICCOV	0.0000	0.0000	1
SNOWREG	3.0000	0.0000	1	ERECDED	0.0000	0.0000	1
CRYOREG	1.0000	0.0000	1	PROSDED	0.0000	0.0000	1
HUMMOCK	1.0000	0.0000	1				

Table C2. Species data summaries of all stand types.

STAND TYPE B1
NUMBER OF PLOTS 6
PLOT NUMBERS 010B 1001 1411 1505 1513 1520

TAXON	MEAN PCT COVER	STAND DEV	N
ARCTAGROSTIS LATIFOLIA S.L.	+	+	1
ASTRAGALUS UMBELLATUS	0.6	0.6	4
BRAYA PURPURASCENS	+	+	1
CAREX MISANDRA MISANDRA	+	+	1
CAREX ROTUNDATA	+	+	1
CAREX RUPESTRIS	3.1	3.0	4
CAREX SCIRPOIDEA	0.2	0.5	2
CAREX SP.	+	+	1
CASSIOPE TETRAGONA TETRAGONA	0.3	0.7	1
CHRYSANTHEMUM INTEGRIFOLIUM	0.1	0.1	2
DRABA ALPINA	0.1	0.1	4
DRYAS INTEGRIFOLIA INTEGRIFOLIA	47.9	19.8	6
EQUISETUM VARIEGATUM	+	+	1
ERIOPHORUM ANGUSTIFOLIUM S.L.	+	+	1
KOBRESIA MYOSUROIDES	+	+	1
LLOYDIA SEROTINA	0.1	0.1	3
MINUARTIA ARCTICA	0.2	0.3	4
OXYTROPIS NIGRESCENS BRYOPHILA	2.4	3.9	4
PAPAVER MACOUNII	0.1	0.1	4
PARRYA NUDICAULIS NUDICAULIS	0.2	0.4	2
PEDICULARIS CAPITATA	0.1	0.1	3
PEDICULARIS LANATA	0.1	0.1	4
POA SP.	+	+	2
POLYGONUM VIVIPARUM	0.1	0.1	3
SALIX RETICULATA RETICULATA	0.4	0.9	2
SALIX ROTUNDIFOLIA ROTUNDIFOLIA	0.1	0.1	4
SAUSSUREA ANGUSTIFOLIA	0.2	0.5	1
SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	3.1	3.3	6
STELLARIA LAETA	+	+	1
UNKNOWN DICOT	+	+	1
BLEPHAROSTOMA TRICHOPHYLLUM BREVIRETE	+	+	1
PLAGIOCHILA ARCTICA	+	+	2
UNKNOWN LEAFY LIVERWORTS	+	+	2
BRACHYTHECIACEAE	+	+	1
BRYUM SP.	0.1	0.1	4
CRATONEURON ARCTICUM	+	+	2
DIDYMODON ASPERIFOLIUS	+	+	1
DISTICHIUM CAPILLACEUM	0.6	0.8	4
DITRICHUM FLEXICAULE	1.5	1.4	6
DREPANOCLADUS UNCINATUS	0.4	0.5	5
ENCALYPTA ALPINA	+	+	2
ENCALYPTA SP	+	+	1
HYPNUM BAMBERGERI	+	+	2
HYPNUM CUPRESSIFORME	0.3	0.8	1
HYPNUM PROCERRIMUM	0.4	0.5	5
ONCOPHORUS WAHLENBERGII	+	+	1
RHYTIDIUM RUGOSUM	0.1	0.2	4
THUIDIUM ABIETINUM	0.9	1.2	6
TOMENTHYPNUM NITENS	1.0	1.5	3
TORTULA RURALIS	+	+	2
UNKNOWN MOSS	0.1	0.0	5
ALECTORIA NIGRICANS	0.1	0.1	4
CALOPLACA SP.	0.1	0.1	4
CETRARIA CUCULLATA	0.4	0.4	6
CETRARIA ISLANDICA	0.3	0.2	5
CETRARIA NIVALIS	0.6	0.8	5
CETRARIA RICHARDSONII	0.1	0.2	2
CETRARIA TILESII	+	+	1
CLADONIA POCILLUM	+	+	1
CLADONIA SP.	+	+	1
CORNICULARIA DIVERGENS	+	+	1
DACTYLINA ARCTICA	0.1	0.1	5
EVERNIA PERFRAGILIS	0.4	0.7	4
FULGENSIA BRACTEATA	+	+	1
HYPOGYMNIA SUBOBSCURA	0.2	0.3	4
LECANORA EPIBRYON	6.8	4.3	6
LECIDEA VERNALIS	+	+	2
LOPADIUM FECUNDUM	3.1	4.4	5
OCHROLECHIA FRIGIDA	+	+	1
PELTIGERA CANINA S.L.	+	+	2
PERTUSARIA CORIACEA	0.8	1.2	3
PERTUSARIA SP.	0.1	0.1	2
PHYSCONIA MUSCIGENA	0.2	0.4	4
SOLORINA SP.	0.1	0.1	2
STEREOCAULON ALPINUM	0.1	0.1	3
THAMNOLIA SUBULIFORMIS	2.7	1.4	6
XANTHORIA ELEGANS	+	+	2
UNKNOWN CRUSTOSE LICHEN	0.9	0.5	6
UNKNOWN FRUTICOSE LICHEN	+	+	2

STAND TYPE B2
NUMBER OF PLOTS 3
PLOT NUMBERS 010A 1401 1412

TAXON	MEAN PCT COVER	STAND DEV	N
ALOPECURUS ALPINUS ALPINUS	+	+	1
ARTEMISIA ARCTICA ARCTICA	0.9	1.5	1
CARDAMINE DIGITATA	0.1	0.0	3
CAREX MISANDRA MISANDRA	1.4	2.3	2
CAREX ROTUNDATA	0.2	0.3	2
CAREX RUPESTRIS	0.2	0.4	1
CAREX SP.	+	+	1
CASSIOPE TETRAGONA TETRAGONA	0.1	0.1	2
CHRYSANTHEMUM INTEGRIFOLIUM	0.1	0.2	1
DRABA ALPINA	0.1	0.1	2
DRABA LACTEA	+	+	1
DRYAS INTEGRIFOLIA INTEGRIFOLIA	51.2	7.6	3
ERIOPHORUM ANGUSTIFOLIUM S.L.	0.1	0.1	2
EUTREMA EDWARDSII	+	+	1
FESTUCA BAFFINENSIS	+	+	1
JUNCUS BIGLUMIS	+	+	1
LESQUERELLA ARCTICA	+	+	1
LUZULA ARCTICA	+	+	1
LUZULA CONFUSA	+	+	1
MINUARTIA ARCTICA	0.6	1.1	1
OXYTROPIS NIGRESCENS BRYOPHILA	+	+	1
PAPAVER LAPPONICUM OCCIDENTALE	0.1	0.2	1
PAPAVER MACOUNII	0.5	0.5	3
PEDICULARIS CAPITATA	0.8	0.7	2
PEDICULARIS LANATA	0.1	0.1	2
POA ARCTICA	0.3	0.5	1
POA SP.	0.1	0.2	1
POLYGONUM VIVIPARUM	0.3	0.3	3
SALIX ARCTICA	0.1	0.1	2
SALIX OVALIFOLIA OVALIFOLIA	0.1	0.2	1
SALIX RETICULATA RETICULATA	3.8	3.0	3
SALIX ROTUNDIFOLIA ROTUNDIFOLIA	2.8	2.5	3
SAUSSUREA ANGUSTIFOLIA	1.9	1.8	2
SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	4.9	6.5	2
SENECIO ATROPURPUREUS FRIGIDUS	0.1	0.0	3
SILENE ACAULIS	0.4	0.5	2
STELLARIA LAETA	0.3	0.6	1
UNKNOWN DICOT	+	+	1
UNKNOWN LEAFY LIVERWORTS	+	+	1
AULACOMNIUM TURGIDUM	0.3	0.6	1
BRACHYTHECIACEAE	+	+	1
BRYUM STENOTRICHUM	+	+	1
BRYUM SP.	0.5	0.5	3
CAMPYLIUM STELLATUM	+	+	1
CRATONEURON ARCTICUM	+	+	1
DICRANUM SP.	0.8	1.4	1
DISTICHIUM CAPILLACEUM	1.8	0.9	3
DISTICHIUM INCLINATUM	+	+	1
DITRICHUM FLEXICAULE	8.2	12.8	3
DREPANOCLADUS LYCOPODIOIDES BREVIFOLIUS	0.1	0.2	1
DREPANOCLADUS UNCINATUS	1.6	2.7	1
ENCALYPTA ALPINA	1.1	1.6	2
ENCALYPTA SP.	0.5	0.5	2
HYPNUM SP.	0.1	0.2	1
LEPTOBRYUM PYRIFORME	+	+	1
ONCOPHORUS WAHLENBERGII	+	+	1
PHILONOTIS FONTANA PUMILA	+	+	1
POLITRICHASTRUM ALPINUM	0.4	0.6	1
POHLIA SP.	+	+	1
RHYTIDIUM RUGOSUM	1.4	2.3	2
TETRAPLODON MNIOIDES	+	+	1
THUIDIUM ABIETINUM	0.1	0.1	2
TIMMIA AUSTRIACA	0.1	0.2	1
TOMENTHYPNUM NITENS	1.5	1.7	2
TORTELLA ARCTICA	0.8	1.4	1
TORTULA RURALIS	+	+	1
UNKNOWN MOSS	0.5	0.7	2
ALECTORIA NIGRICANS	0.2	0.2	2
CALOPLACA SP.	0.1	0.1	2
CETRARIA CUCULLATA	0.8	0.6	3
CETRARIA ISLANDICA	1.4	0.9	3
CETRARIA NIVALIS	0.6	0.5	3
CETRARIA RICHARDSONII	0.1	0.1	2
CLADONIA POCILLUM	0.1	0.0	3
CORNICULARIA DIVERGENS	0.4	0.6	2
DACTYLINA ARCTICA	0.3	0.2	3
EVERNIA PERFRAGILIS	0.1	0.1	2
HYPOGYMNIA SUBOBSCURA	0.4	0.5	2
LECANORA EPIBRYON	3.9	3.3	3
LECIDEA VERNALIS	0.1	0.1	2
LOPADIUM FECUNDUM	2.4	1.3	3
OCHROLECHIA FRIGIDA	0.9	1.6	1
OCHROLECHIA FRIGIDA TELEPHOROIDES	0.3	0.6	1
PELTIGERA APHTHOSA	0.1	0.1	2
PELTIGERA CANINA S.L.	0.1	0.1	2
PELTIGERA SPURIA SOREDIATA	0.7	1.2	1
PERTUSARIA SP.	+	+	1
PHYSCONIA MUSCIGENA	0.1	0.2	2
SOLORINA SP.	0.1	0.1	1
STEREOCAULON ALPINUM	+	+	1
THAMNOLIA SUBULIFORMIS	1.6	2.1	2
UNKNOWN CRUSTOSE LICHEN	4.5	3.3	3
UNKNOWN FRUTICOSE LICHEN	0.1	0.1	1

Table C2 (cont'd). Species data summaries of all stand types.

STAND TYPE B3
NUMBER OF PLOTS 3
PLOT NUMBERS 0801 1419 1506

TAXON	MEAN PCT COVER	STAND DEV	N
ARCTAGROSTIS LATIFOLIA S.L.	0.3	0.6	1
CARDAMINE DIGITATA	+	+	1
CAREX AQUATILIS S.L.	+	+	1
CAREX MISANDRA MISANDRA	+	+	1
CAREX ROTUNDATA	+	+	1
CAREX RUPESTRIS	1.0	1.7	1
CAREX SP.	1.0	1.0	2
CHRYSANTHEMUM INTEGRIFOLIUM	+	+	1
DRABA LACTEA	+	+	1
DRYAS INTEGRIFOLIA INTEGRIFOLIA	18.0	10.6	3
EQUISETUM VARIEGATUM	0.1	0.0	3
ERIOPHORUM ANGUSTIFOLIUM S.L.	5.3	8.4	2
JUNCUS BIGLUMIS	0.1	0.1	2
LUZULA ARCTICA	+	+	1
MINUARTIA ARCTICA	0.4	0.6	2
PAPAVER MACOUNII	0.1	0.1	2
PEDICULARIS CAPITATA	+	+	1
PEDICULARIS LANATA	.0	1.7	2
POLYGONUM VIVIPARUM	0.4	0.6	2
SALIX ARCTICA	+	+	1
SALIX RETICULATA RETICULATA	0.1	0.1	2
SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	8.0	6.9	2
SENECIO ATROPURPUREUS *FRIGIDUS*	+	+	1
SILENE ACAULIS	0.3	0.6	1
STELLARIA LAETA	0.3	0.6	1
UNKNOWN DICOT	0.1	0.1	2
BRACHYTHECIACEAE	+	+	1
BRYUM WRIGHTII	+	+	1
BRYUM SP.	0.1	0.1	2
DISTICHIUM CAPILLACEUM	0.4	0.5	3
DITRICHUM FLEXICAULE	4.0	6.9	2
DREPANOCLADUS UNCINATUS	5.0	8.6	2
ENCALYPTA ALPINA	+	+	1
ENCALYPTA SP.	+	+	1
HYPNUM BAMBERGERI	0.4	0.6	2
HYPNUM PROCERRIMUM	1.3	2.3	1
POLYTRICHACEAE	+	+	1
RHACOMITRIUM LANUGINOSUM	0.3	0.6	1
RHYTIDIUM RUGOSUM	0.3	0.6	1
TOMENTHYPNUM NITENS	3.3	3.5	2
UNKNOWN MOSS	+	+	1
ALECTORIA NIGRICANS	0.3	0.6	1
CETRARIA CUCULLATA	0.4	0.5	3
CETRARIA ISLANDICA	0.7	0.5	3
CETRARIA NIVALIS	0.3	0.6	1
CLADONIA POCILLUM	0.7	0.6	2
DACTYLINA ARCTICA	*0.7*	*0.6*	2
DACTYLINA RAMULOSA	0.3	0.6	1
LECANORA EPIBRYON	1.0	1.0	3
LOPADIUM FECUNDUM	3.3	5.8	1

STAND TYPE B4
NUMBER OF PLOTS 2
PLOT NUMBERS 1105 1521

TAXON	MEAN PCT COVER	STAND DEV	N
ALOPECURUS ALPINUS ALPINUS	0.1	0.1	1
ARCTAGROSTIS LATIFOLIA S.L.	0.1	0.1	1
ARMERIA MARITIMA ARCTICA	0.1	0.1	1
ARTEMISIA ARCTICA ARCTICA	0.1	0.1	1
ARTEMISIA BOREALIS	1.5	0.7	2
ARTEMISIA GLOMERATA	0.6	0.6	2
ASTRAGALUS *ALPINUS*	0.1	0.1	1
BRAYA PURPURASCENS	0.5	0.7	1
CAREX AQUATILIS S.L.	0.1	0.1	1
DUPONTIA FISHERI S.L.	0.1	0.1	1
ELYMUS ARENARIUS MOLLIS VILLOSISSIMUS	1.0	1.4	1
EPILOBIUM LATIFOLIUM	3.0	2.8	2
EQUISETUM ARVENSE	0.1	0.1	1
LESQUERELLA ARCTICA	0.5	0.7	1
PAPAVER LAPPONICUM OCCIDENTALE	0.1	0.1	1
PARRYA NUDICAULIS NUDICAULIS	0.1	0.1	1
POA SP.	0.1	0.1	1
POLEMONIUM BOREALE	0.1	0.1	1
POLYGONUM VIVIPARUM	0.1	0.1	1
SALIX OVALIFOLIA OVALIFOLIA	0.1	0.0	2
SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	0.6	0.6	2
TRISETUM SPICATUM SPICATUM	0.1	0.1	1
WILHELMSIA PHYSODES	0.1	0.1	1
OCHROLECHIA FRIGIDA TELEPHOROIDES	0.3	0.6	1
SOLORINA SP.	0.7	1.2	1
THAMNOLIA SUBULIFORMIS	4.7	1.5	3
UNKNOWN CRUSTOSE LICHEN	5.0	8.6	2

STAND TYPE B5
NUMBER OF PLOTS 1
PLOT NUMBERS 1207

TAXON	MEAN PCT COVER	STAND DEV	N
ALOPECURUS ALPINUS ALPINUS	0.1	0.0	1
ANDROSACE CHAMAEJASME LEHMANNIANA	0.1	0.0	1
ARCTAGROSTIS LATIFOLIA S.L.	0.1	0.0	1
ARTEMISIA BOREALIS	2.9	0.0	1
CAREX RUPESTRIS	0.1	0.0	1
CAREX SCIRPOIDEA	0.1	0.0	1
CHRYSANTHEMUM INTEGRIFOLIUM	0.3	0.0	1
DRYAS INTEGRIFOLIA INTEGRIFOLIA	38.0	0.0	1
KOBRESIA MYOSUROIDES	1.7	0.0	1
OXYTROPIS NIGRESCENS BRYOPHILA	0.1	0.0	1
PARRYA NUDICAULIS NUDICAULIS	0.1	0.0	1
PEDICULARIS CAPITATA	0.3	0.0	1
POLYGONUM VIVIPARUM	1.5	0.0	1
SALIX ARCTICA	0.3	0.0	1
SALIX OVALIFOLIA OVALIFOLIA	0.6	0.0	1
SALIX RETICULATA RETICULATA	0.4	0.0	1
SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	0.4	0.0	1
UNKNOWN MOSS	0.4	0.0	1
TONINIA CUMULATA	1.3	0.0	1

STAND TYPE B6
NUMBER OF PLOTS 1
PLOT NUMBERS 1507

TAXON	MEAN PCT COVER	STAND DEV	N
ANDROSACE CHAMAEJASME LEHMANNIANA	0.1	0.0	1
ANEMONE RICHARDSONII	0.2	0.0	1
ASTRAGALUS ALPINUS	3.5	0.0	1
ASTRAGALUS UMBELLATUS	1.4	0.0	1
CAREX RUPESTRIS	1.5	0.0	1
CAREX *SCIRPOIDEA*	*4.6*	*0.0*	1
CHRYSANTHEMUM INTEGRIFOLIUM	0.6	0.0	1
DRABA ALPINA	0.1	0.0	1
DRYAS INTEGRIFOLIA INTEGRIFOLIA	42.1	0.0	1
EQUISETUM VARIEGATUM	0.2	0.0	1
GENTIANELLA PROPINQUA PROPINQUA	0.2	0.0	1
KOBRESIA MYOSUROIDES	1.0	0.0	1
LLOYDIA SEROTINA	0.1	0.0	1
MINUARTIA ARCTICA	0.1	0.0	1
OXYTROPIS BOREALIS	1.3	0.0	1
OXYTROPIS NIGRESCENS BRYOPHILA	0.2	0.0	1
PAPAVER MACOUNII	0.2	0.0	1
PARRYA NUDICAULIS NUDICAULIS	0.2	0.0	1
PEDICULARIS CAPITATA	0.2	0.0	1
PEDICULARIS LANATA	0.2	0.0	1
POA SP.	0.1	0.0	1
POLYGONUM VIVIPARUM	0.6	0.0	1
SALIX LANATA *RICHARDSONII*	*0.1*	0.0	1
SALIX RETICULATA RETICULATA	3.3	0.0	1
SALIX ROTUNDIFOLIA ROTUNDIFOLIA	5.4	0.0	1
SAUSSUREA ANGUSTIFOLIA	0.1	0.0	1
SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	2.9	0.0	1
SENECIO RESEDIFOLIUS	0.1	0.0	1
SILENE ACAULIS	0.3	0.0	1
UNKNOWN DICOT	0.1	0.0	1
ANEURA PINGUIS	0.1	0.0	1
BRYUM SP.	0.1	0.0	1
CAMPYLIUM STELLATUM	0.2	0.0	1
DIDYMODON ASPERIFOLIUS	0.5	0.0	1
DISTICHIUM CAPILLACEUM	6.9	0.0	1
DITRICHUM FLEXICAULE	16.0	0.0	1
DREPANOCLADUS UNCINATUS	5.1	0.0	1
ENCALYPTA SP.	0.1	0.0	1
HYPNUM PROCERRIMUM	0.1	0.0	1
ORTHOTHECIUM CHRYSEUM	*0.2*	0.0	1
THUIDIUM ABIETINUM	0.1	0.0	1
TOMENTHYPNUM NITENS	0.5	0.0	1
TORTELLA ARCTICA	1.0	0.0	1
UNKNOWN MOSS	1.5	0.0	1
CETRARIA DELISEI	0.1	0.0	1
LECANORA EPIBRYON	0.1	0.0	1
LOPADIUM FECUNDUM	0.1	0.0	1
PERTUSARIA SP.	0.1	0.0	1
THAMNOLIA SUBULIFORMIS	0.1	0.0	1
UNKNOWN CRUSTOSE LICHEN	0.1	0.0	1

Table C2 (cont'd).

STAND TYPE B7
NUMBER OF PLOTS 1
PLOT NUMBERS 1104

TAXON	MEAN PCT COVER	STAND DEV	N
BRAYA PURPURASCENS	8.0	0.0	1
EPILOBIUM LATIFOLIUM	23.0	0.0	1
POA SP	0.1	0.0	1
POLYGONUM VIVIPARUM	0.1	0.0	1
SALIX ARCTICA	1.0	0.0	1
SALIX RETICULATA RETICULATA	1.0	0.0	1
SALIX ROTUNDIFOLIA ROTUNDIFOLIA	1.0	0.0	1
LEPTOBRYUM PYRIFORME	0.1	0.0	1

STAND TYPE B8
NUMBER OF PLOTS 1
PLOT NUMBERS 1312

TAXON	MEAN PCT COVER	STAND DEV	N
COCHLEARIA OFFICINALIS ARCTICA	1.3	0.0	1
DUPONTIA FISHERI S.L.	0.1	0.0	1
PUCCINELLIA ANDERSONII	0.4	0.0	1
PUCCINELLIA PHRYGANODES	6.4	0.0	1
STELLARIA HUMIFUSA	3.0	0.0	1

STAND TYPE B9
NUMBER OF PLOTS 1
PLOT NUMBERS 1201

TAXON	MEAN PCT COVER	STAND DEV	N
DUPONTIA FISHERI S.L.	0.1	0.0	1
ELYMUS ARENARIUS MOLLIS VILLOSISSIMUS	3.3	0.0	1
POLLOONIUM BOREALE	0.1	0.0	1

STAND TYPE B10
NUMBER OF PLOTS 1
PLOT NUMBERS 1301

TAXON	MEAN PCT COVER	STAND DEV	N
BRAYA PURPURASCENS	5.0	0.0	1
PUCCINELLIA ANDERSONII	3.0	0.0	1
UNKNOWN MONOCOT	0.1	0.0	1
BRYUM SP	0.1	0.0	1
CALLIERGON RICHARDSONII ROBUSTUM	0.1	0.0	1
ENCALYPTA SP	0.1	0.0	1
TOMENTHYPNUM NITENS	0.1	0.0	1
UNKNOWN MOSS	1.0	0.0	1
FULGENSIA BRACTEATA	1.0	0.0	1
LECANORA EPIBRYON	0.1	0.0	1
LOPADIUM FECUNDUM	2.0	0.0	1
THAMNOLIA SUBULIFORMIS	3.0	0.0	1

STAND TYPE B12
NUMBER OF PLOTS 1
PLOT NUMBERS 1305

TAXON	MEAN PCT COVER	STAND DEV	N
ARCTAGROSTIS LATIFOLIA S.L.	0.3	0.0	1
BRAYA SP.	0.1	0.0	1
CAREX RUPESTRIS	0.1	0.0	1
DRABA LACTEA	0.6	0.0	1
FESTUCA BAFFINENSIS	0.4	0.0	1
LUZULA ARCTICA	0.1	0.0	1
POA ARCTICA	2.8	0.0	1
SALIX ARCTICA	0.1	0.0	1
SALIX PLANIFOLIA PULCHRA PULCHRA	2.2	0.0	1
SALIX RETICULATA RETICULATA	0.1	0.0	1
SALIX ROTUNDIFOLIA ROTUNDIFOLIA	14.0	0.0	1
SENECIO ATROPURPUREUS FRIGIDUS	0.1	0.0	1
STELLARIA LAETA	0.5	0.0	1
UNKNOWN LEAFY LIVERWORTS	0.1	0.0	1
AULACOMNIUM PALUSTRE	0.1	0.0	1
BRYUM SP.	0.1	0.0	1
CALLIERGON SP.	0.1	0.0	1
DICRANUM ANGUSTUM	0.1	0.0	1
DICRANUM ELONGATUM	0.7	0.0	1
MNIUM BLYTTII	0.1	0.0	1
ONCOPHORUS WAHLENBERGII	0.1	0.0	1
POLITRICHASTRUM ALPINUM	0.1	0.0	1
POHLIA NUTANS	0.1	0.0	1
TETRAPLODON MNIOIDES	0.1	0.0	1
UNKNOWN MOSS	0.1	0.0	1
ALECTORIA NIGRICANS	0.1	0.0	1
CETRARIA CUCULLATA	0.1	0.0	1
CETRARIA ISLANDICA	0.3	0.0	1
CETRARIA NIVALIS	0.1	0.0	1
CLADONIA GRACILIS	0.1	0.0	1
CLADONIA POCILLUM	0.4	0.0	1
CLADONIA SP.	0.1	0.0	1
DACTYLINA ARCTICA	0.2	0.0	1
GYALECTA FOVEOLARIS	0.1	0.0	1
HYPOGYMNIA SUBOBSCURA	0.1	0.0	1
LECANORA EPIBRYON	4.1	0.0	1
LECIDEA VERNALIS	0.1	0.0	1
OCHROLECHIA FRIGIDA	0.1	0.0	1
OCHROLECHIA FRIGIDA TELEPHOROIDES	0.1	0.0	1
SPHAEROPHORUS GLOBOSUS	0.1	0.0	1
THAMNOLIA SUBULIFORMIS	0.1	0.0	1
UNKNOWN CRUSTOSE LICHEN	18.0	0.0	1

Table C2 (cont'd). Species data summaries of all stand types.

STAND TYPE B13
NUMBER OF PLOTS 3
PLOT NUMBERS 1106 1202 1208

TAXON	MEAN PCT COVER	STAND DEV	N
ALOPECURUS ALPINUS ALPINUS	+	+	1
ANDROSACE CHAMAEJASME LEHMANNIANA	0.5	0.5	3
ANEMONE PARVIFLORA	1.0	1.7	1
ARCTAGROSTIS LATIFOLIA S.L.	+	+	1
ARMERIA MARITIMA ARCTICA	+	+	1
ARTEMISIA ARCTICA ARCTICA	0.3	0.6	1
ARTEMISIA BOREALIS	1.5	1.3	2
ARTEMISIA GLOMERATA	0.1	0.1	2
ASTRAGALUS ALPINUS	2.7	4.6	1
BRAYA PURPURASCENS	+	+	1
CAREX SP	1.0	1.7	1
CHRYSANTHEMUM INTEGRIFOLIUM	+	+	1
DRABA ALPINA	0.1	0.1	2
DRYAS INTEGRIFOLIA INTEGRIFOLIA	8.7	14.2	2
DUPONTIA FISHERI S.L.	0.3	0.6	1
EPILOBIUM LATIFOLIUM	1.3	2.3	1
EQUISETUM VARIEGATUM	0.7	1.2	1
ERIOPHORUM ANGUSTIFOLIUM S.L.	0.3	0.6	1
PARRYA NUDICAULIS NUDICAULIS	0.1	0.1	2
PEDICULARIS CAPITATA	+	+	1
PEDICULARIS LANATA	0.1	0.0	3
POLEMONIUM BOREALE	+	+	1
POLYGONUM VIVIPARUM	1.0	1.0	3
POTENTILLA UNIFLORA	0.1	0.1	2
SALIX OVALIFOLIA OVALIFOLIA	14.6	9.1	3
SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	2.0	3.5	1
SENECIO RESEDIFOLIUS	+	+	1
STELLARIA LAETA	0.1	0.1	2
BRYUM SP	1.7	2.9	1
DISTICHIUM CAPILLACEUM	6.7	11.5	1
DITRICHUM FLEXICAULE	0.7	1.2	1
UNKNOWN MOSS	0.7	1.2	1
UNKNOWN CRUSTOSE LICHEN	0.1	0.1	2
UNKNOWN FRUTICOSE LICHEN	1.6	2.8	1
NOSTOC SP.	+	+	1

STAND TYPE B14
NUMBER OF PLOTS 1
PLOT NUMBERS 1421

TAXON	MEAN PCT COVER	STAND DEV	N
ASTRAGALUS UMBELLATUS	5.0	0.0	1
DRYAS INTEGRIFOLIA INTEGRIFOLIA	75.0	0.0	1
ERIGERON ERIOCEPHALUS	0.1	0.0	1
PAPAVER MACOUNII	0.1	0.0	1
PEDICULARIS CAPITATA	0.1	0.0	1
SALIX RETICULATA RETICULATA	20.0	0.0	1
TRISETUM SPICATUM SPICATUM	0.1	0.0	1
BRYUM SP.	1.0	0.0	1
DISTICHIUM CAPILLACEUM	2.0	0.0	1
RHYTIDIUM RUGOSUM	5.0	0.0	1
THUIDIUM ABIETINUM	5.0	0.0	1
TIMMIA AUSTRIACA	3.0	0.0	1
TOMENTHYPNUM NITENS	2.0	0.0	1
UNKNOWN MOSS	1.0	0.0	1
CETRARIA CUCULLATA	5.0	0.0	1
CETRARIA ISLANDICA	2.0	0.0	1
CETRARIA NIVALIS	5.0	0.0	1
CETRARIA RICHARDSONII	10.0	0.0	1
DACTYLINA ARCTICA	2.0	0.0	1
THAMNOLIA SUBULIFORMIS	1.0	0.0	1
UNKNOWN CRUSTOSE LICHEN	1.0	0.0	1
UNKNOWN FRUTICOSE LICHEN	1.0	0.0	1

STAND TYPE B15
NUMBER OF PLOTS 1
PLOT NUMBERS 1313

TAXON	MEAN PCT COVER	STAND DEV	N
CAREX AQUATILIS S.L	4.3	0.0	1
CAREX MISANDRA MISANDRA	3.5	0.0	1
CAREX ROTUNDATA	0.1	0.0	1
DRABA LACTEA	0.1	0.0	1
DRYAS INTEGRIFOLIA INTEGRIFOLIA	1.5	0.0	1
ERIOPHORUM ANGUSTIFOLIUM S.L.	0.1	0.0	1
FESTUCA BAFFINENSIS	0.1	0.0	1
JUNCUS BIGLUMIS	0.1	0.0	1
PEDICULARIS LANATA	0.1	0.0	1
POA ARCTICA	0.1	0.0	1
SALIX PLANIFOLIA PULCHRA PULCHRA	2.6	0.0	1
SALIX RETICULATA RETICULATA	1.7	0.0	1
SALIX ROTUNDIFOLIA ROTUNDIFOLIA	0.5	0.0	1
BRYUM SP.	0.1	0.0	1
DICRANUM ANGUSTUM	1.3	0.0	1
POLITRICHASTRUM ALPINUM	1.1	0.0	1
UNKNOWN MOSS	0.1	0.0	1
ALECTORIA NIGRICANS	0.1	0.0	1
ALECTORIA OCHROLEUCA	0.1	0.0	1
CETRARIA CUCULLATA	0.1	0.0	1
CETRARIA ISLANDICA	0.1	0.0	1
CLADONIA GRACILIS	0.1	0.0	1
CLADONIA LEPIDOTA	0.1	0.0	1
CLADONIA POCILLUM	0.2	0.0	1
DACTYLINA ARCTICA	0.1	0.0	1
HYPOGYMNIA SUBOBSCURA	0.1	0.0	1
LECANORA EPIBRYON	0.5	0.0	1
LOPADIUM FECUNDUM	6.5	0.0	1
OCHROLECHIA FRIGIDA	11.0	0.0	1
PELTIGERA CANINA S.L	0.1	0.0	1
SPHAEROPHORUS GLOBOSUS	0.2	0.0	1
THAMNOLIA SUBULIFORMIS	0.3	0.0	1
UNKNOWN FRUTICOSE LICHEN	0.1	0.0	1

Table C2 (cont'd).

STAND TYPE U1
NUMBER OF PLOTS 4
PLOT NUMBERS 1405 1406 1410 1415

TAXON	MEAN PCT COVER	STAND DEV	N
CAREX AQUATILIS S.L.	17.0	15.7	3
CAREX BIGELOWII	2.1	3.9	2
CAREX MISANDRA MISANDRA	3.1	4.7	3
CAREX RARIFLORA	0.3	0.5	1
CAREX SP.	0.1	0.1	2
CASSIOPE TETRAGONA TETRAGONA	+	+	1
DRABA ALPINA	0.1	0.2	1
DRABA LACTEA	0.1	0.1	2
DRYAS INTEGRIFOLIA INTEGRIFOLIA	15.1	2.5	4
EQUISETUM VARIEGATUM	0.1	0.1	3
ERIOPHORUM ANGUSTIFOLIUM S.L.	3.4	4.0	4
EUTREMA EDWARDSII	0.1	0.1	2
FESTUCA RUBRA	+	+	1
JUNCUS BIGLUMIS	+	+	1
LUZULA ARCTICA	0.1	0.1	2
MINUARTIA RUBELLA	+	+	1
PEDICULARIS LANATA	0.1	0.1	2
POLYGONUM VIVIPARUM	+	+	1
SALIX ARCTICA	0.4	0.6	3
SALIX PLANIFOLIA PULCHRA PULCHRA	+	+	1
SALIX RETICULATA RETICULATA	2.2	1.0	4
SALIX ROTUNDIFOLIA ROTUNDIFOLIA	+	+	1
SAXIFRAGA HIRCULUS PROPINQUA	+	+	1
SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	+	+	1
SENECIO ATROPURPUREUS FRIGIDUS	+	+	1
SILENE WAHLBERGELLA ARCTICA	0.1	0.2	1
STELLARIA LAETA	+	+	1
UNKNOWN DICOT	+	+	1
ANEURA PINGUIS	+	+	1
ANASTROPHYLLUM MINUTUM	+	+	1
BLEPHAROSTOMA TRICHOPHYLLUM BREVIRETE	+	+	1
GYMNOCOLEA INFLATA	+	+	1
LOPHOZIA HETEROCOLPA	0.3	0.5	1
LOPHOZIA SP.	+	+	1
PLAGIOCHILA ARCTICA	+	+	1
PTILIDIUM CILIARE	1.0	2.0	1
RADULA PROLIFERA	+	+	1
SCAPANIA SIMMONSII	1.6	1.9	2
UNKNOWN LEAFY LIVERWORTS	0.3	0.5	2
AULACOMNIUM ACUMINATUM	0.3	0.5	2
AULACOMNIUM TURGIDUM	0.1	0.1	3
BRACHYTHECIACEAE	+	+	1
BRYUM STENOTRICHUM	0.1	0.1	2
BRYUM SP.	0.6	0.9	4
CAMPYLIUM STELLATUM	0.6	1.0	3
CINCLIDIUM ARCTICUM	0.3	0.5	1
CINCLIDIUM STYGIUM	+	+	1
CINCLIDIUM SP.	+	+	1
CRATONEURON ARCTICUM	+	+	1
CYRTOMNIUM HYMENOPHYLLUM	+	+	1
DICRANUM ANGUSTUM	0.5	0.6	2
DICRANUM ELONGATUM	0.6	0.5	3
DISTICHIUM CAPILLACEUM	2.5	2.2	4
DISTICHIUM INCLINATUM	0.2	0.2	2
DITRICHUM FLEXICAULE	2.4	4.1	3
DREPANOCLADUS LYCOPODIOIDES BREVIFOLIUS	0.3	0.4	2
DREPANOCLADUS SP.	+	+	1
ENCALYPTA ALPINA	0.4	0.9	1
ENCALYPTA SP.	0.1	0.1	2
FISSIDENS SP.	+	+	1
HYLOCOMIUM SPLENDENS OBTUSIFOLIUM	0.3	0.5	1
HYPNUM BAMBERGERI	+	+	1
HYPNUM PROCERRIMUM	0.3	0.5	1
HYPNUM SP.	+	+	1
MEESIA ULIGINOSA	0.3	0.5	2
ONCOPHORUS WAHLENBERGII	2.3	2.3	4
ORTHOTHECIUM CHRYSEUM	0.7	0.8	3
POLITRICHASTRUM ALPINUM	0.8	1.5	2
POLYTRICHACEAE	+	+	1
RHYTIDIUM RUGOSUM	0.7	0.4	4
TIMMIA AUSTRIACA	+	+	1
TOMENTHYPNUM NITENS	10.2	11.5	4
TORTELLA ARCTICA	2.5	5.0	1
UNKNOWN MOSS	2.7	1.1	4
ALECTORIA NIGRICANS	0.6	0.6	3
CALOPLACA SP.	0.1	0.1	3
CETRARIA CUCULLATA	1.4	0.6	4
CETRARIA ISLANDICA	1.1	0.6	4
CETRARIA NIVALIS	0.2	0.2	4
CETRARIA RICHARDSONII	+	+	1
CLADONIA GRACILIS	0.1	0.0	4
CLADONIA POCILLUM	0.1	0.1	2
CLADONIA SP.	0.4	0.5	3
CORNICULARIA DIVERGENS	+	+	1
DACTYLINA ARCTICA	0.6	0.7	2
DACTYLINA RAMULOSA	0.8	1.0	2
EVERNIA PERFRAGILIS	0.1	0.1	1
HYPOGYMNIA SUBOBSCURA	0.1	0.1	1
LECANORA EPIBRYON	0.3	0.3	3
LECIDEA RAMULOSA	+	+	1
LOPADIUM FECUNDUM	1.4	1.6	2
OCHROLECHIA FRIGIDA	5.4	10.9	1
OCHROLECHIA FRIGIDA TELEPHOROIDES	5.2	8.0	3
PELTIGERA APHTHOSA	0.1	0.3	1
PHYSCONIA MUSCIGENA	+	+	1
SOLORINA SP.	0.1	0.1	3
STEREOCAULON ALPINUM	0.1	0.1	2
THAMNOLIA SUBULIFORMIS	2.0	0.7	4
UNKNOWN CRUSTOSE LICHEN	0.2	0.2	2

STAND TYPE U2
NUMBER OF PLOTS 1
PLOT NUMBERS 0203

TAXON	MEAN PCT COVER	STAND DEV	N
ARCTAGROSTIS LATIFOLIA S.L.	0.1	0.0	1
CARDAMINE DIGITATA	0.1	0.0	1
CAREX BIGELOWII	10.1	0.0	1
CAREX ROTUNDATA	4.7	0.0	1
CASSIOPE TETRAGONA TETRAGONA	2.6	0.0	1
CHRYSANTHEMUM INTEGRIFOLIUM	0.1	0.0	1
DRABA ALPINA	0.1	0.0	1
DRYAS INTEGRIFOLIA INTEGRIFOLIA	20.6	0.0	1
ERIOPHORUM ANGUSTIFOLIUM S.L.	7.9	0.0	1
ERIOPHORUM VAGINATUM	9.5	0.0	1
MINUARTIA ARCTICA	0.1	0.0	1
PAPAVER MACOUNII	0.1	0.0	1
SALIX ARCTICA	0.9	0.0	1
SALIX LANATA RICHARDSONII	0.1	0.0	1
SALIX RETICULATA RETICULATA	0.4	0.0	1
SALIX ROTUNDIFOLIA ROTUNDIFOLIA	0.1	0.0	1
SAXIFRAGA HIRCULUS PROPINQUA	0.1	0.0	1
SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	0.1	0.0	1
SENECIO ATROPURPUREUS FRIGIDUS	0.2	0.0	1
UNKNOWN DICOT	0.1	0.0	1
ANASTROPHYLLUM MINUTUM	0.1	0.0	1
PLAGIOCHILA ARCTICA	0.8	0.0	1
RADULA PROLIFERA	0.1	0.0	1
BRACHYTHECIACEAE	0.1	0.0	1
CAMPYLIUM STELLATUM	0.7	0.0	1
CATOSCOPIUM NIGRITUM	0.1	0.0	1
CINCLIDIUM ARCTICUM	1.5	0.0	1
CRATONEURON ARCTICUM	0.1	0.0	1
CTENIDIUM MOLLUSCUM	4.7	0.0	1
DISTICHIUM CAPILLACEUM	12.5	0.0	1
DITRICHUM FLEXICAULE	16.5	0.0	1
ENCALYPTA ALPINA	0.3	0.0	1
HYPNUM BAMBERGERI	1.8	0.0	1
ORTHOTHECIUM CHRYSEUM	0.1	0.0	1
RHYTIDIUM RUGOSUM	3.5	0.0	1
TOMENTHYPNUM NITENS	57.0	0.0	1
TORTULA RURALIS	0.1	0.0	1
UNKNOWN MOSS	0.3	0.0	1
CETRARIA CUCULLATA	0.5	0.0	1
CETRARIA ISLANDICA	3.1	0.0	1
CETRARIA NIVALIS	0.2	0.0	1
CETRARIA RICHARDSONII	0.1	0.0	1
CETRARIA TILESII	0.1	0.0	1
CLADONIA POCILLUM	0.1	0.0	1
DACTYLINA ARCTICA	0.1	0.0	1
LECANORA EPIBRYON	0.2	0.0	1
PELTIGERA APHTHOSA	0.4	0.0	1
SOLORINA SP.	0.1	0.0	1
STEREOCAULON ALPINUM	0.1	0.0	1
THAMNOLIA SUBULIFORMIS	6.0	0.0	1
NOSTOC SP.	0.1	0.0	1

Table C2 (cont'd). Species data summaries of all stand types.

STAND TYPE U3
NUMBER OF PLOTS 8
PLOT NUMBERS 020A 020B 1403 1504 1510 1512 1515 1519

TAXON	MEAN PCT COVER	STAND DEV	N
ARCTAGROSTIS LATIFOLIA S.L.	0.1	0.1	4
CARDAMINE DIGITATA	+	+	3
CAREX AQUATILIS S.L.	0.2	0.5	2
CAREX BIGELOWII	6.7	7.2	5
CAREX MARINA	0.1	0.3	1
CAREX MISANDRA MISANDRA	+	+	2
CAREX ROTUNDATA	10.4	9.1	6
CAREX RUPESTRIS	+	+	1
CAREX SCIRPOIDEA	0.1	0.1	2
CAREX SP	+	+	3
CASSIOPE TETRAGONA TETRAGONA	0.4	0.6	3
CHRYSANTHEMUM INTEGRIFOLIUM	0.1	0.1	5
DRABA ALPINA	0.1	0.1	3
DRYAS INTEGRIFOLIA INTEGRIFOLIA	32.3	20.7	7
DUPONTIA FISHERI S.L.	+	+	1
EQUISETUM VARIEGATUM	0.2	0.3	5
ERIOPHORUM ANGUSTIFOLIUM S.L.	13.4	6.4	7
ERIOPHORUM VAGINATUM	0.5	1.2	2
EUTREMA EDWARDSII	+	+	1
JUNCUS BIGLUMIS	+	+	1
LUZULA ARCTICA	+	+	1
MINUARTIA ARCTICA	0.1	0.2	2
PAPAVER MACOUNII	0.1	0.2	4
PEDICULARIS CAPITATA	+	+	2
PEDICULARIS LANATA	0.2	0.2	6
POLYGONUM VIVIPARUM	0.1	0.1	4
SALIX ARCTICA	1.3	1.0	6
SALIX LANATA RICHARDSONII	+	+	2
SALIX PLANIFOLIA PULCHRA PULCHRA	+	+	1
SALIX RETICULATA RETICULATA	1.7	3.2	6
SALIX ROTUNDIFOLIA ROTUNDIFOLIA	0.2	0.4	3
SAXIFRAGA HIRCULUS PROPINQUA	+	+	2
SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	0.7	0.8	6
SENECIO ATROPURPUREUS FRIGIDUS	0.2	0.2	5
STELLARIA LAETA	+	+	1
UNKNOWN MONOCOT	+	+	3
UNKNOWN DICOT	0.1	0.1	3
ANEURA PINGUIS	+	+	2
ANASTROPHYLLUM MINUTUM	+	+	1
BLEPHAROSTOMA TRICHOPHYLLUM BREVIRETE	+	+	2
GYMNOCOLEA INFLATA	+	+	1
LOPHOZIA BINSTEADII	+	+	1
LOPHOZIA QUADRILOBA	+	+	1
PLAGIOCHILA ARCTICA	+	+	2
PTILIDIUM CILIARE	1.8	4.7	1
RADULA PROLIFERA	+	+	2
SCAPANIA SIMMONSII	0.3	0.8	1
UNKNOWN LEAFY LIVERWORTS	0.2	0.4	2
AULACOMNIUM TURGIDUM	+	+	2
BRACHYTHECIACEAE	0.4	0.8	3
BRACHYTHECIUM GROENLANDICUM	+	+	1
BRYUM STENOTRICHUM	+	+	1
BRYUM SP.	0.1	0.1	5
CALLIERGON RICHARDSONII ROBUSTUM	0.2	0.4	2
CALLIERGON SP.	+	+	1
CAMPYLIUM STELLATUM	1.6	1.9	5
CATOSCOPIUM NIGRITUM	1.3	2.8	5
CINCLIDIUM ARCTICUM	+	+	1
CINCLIDIUM LATIFOLIUM	0.2	0.4	2
CINCLIDIUM STYGIUM	+	+	1
CIRRIPHYLLUM CIRROSUM	0.1	0.2	2
CRATONEURON ARCTICUM	0.1	0.1	4
DICRANUM ANGUSTUM	0.5	1.4	1
DIDYMODON ASPERIFOLIUS	+	+	2
DISTICHIUM CAPILLACEUM	4.2	2.6	7
DISTICHIUM INCLINATUM	0.1	0.2	1
DITRICHUM FLEXICAULE	23.1	11.1	7
DREPANOCLADUS LYCOPODIOIDES BREVIFOLIUS	2.0	2.9	3
DREPANOCLADUS SP.	+	+	1
ENCALYPTA ALPINA	0.3	0.5	5
ENCALYPTA PROCERA	+	+	1
ENCALYPTA SP.	0.2	0.6	2
FISSIDENS OSMUNDOIDES	+	+	1
HYLOCOMIUM SPLENDENS OBTUSIFOLIUM	1.6	4.3	1
HYPNUM BAMBERGERI	4.9	4.9	6
HYPNUM PROCERRIMUM	0.8	1.3	4
HYPNUM REVOLUTUM	+	+	1
HYPNUM SP.	0.6	1.5	2
MEESIA TRIQUETRA	+	+	1
MEESIA ULIGINOSA	0.2	0.2	6
MNIUM ANDREWSIANUM	+	+	1
ONCOPHORUS WAHLENBERGII	0.3	0.4	5
ORTHOTHECIUM CHRYSEUM	2.8	4.8	5
PHILONOTIS FONTANA PUMILA	0.7	1.9	1
PLAGIOPUS OEDERIANA	+	+	1
POLYTRICHACEAE	+	+	1
RHACOMITRIUM LANUGINOSUM	+	+	1
RHYTIDIUM RUGOSUM	+	+	1
SCORPIDIUM TURGESCENS	+	+	1
TETRAPLODON MNIOIDES	+	+	1
THUIDIUM ABIETINUM	+	+	2
TIMMIA AUSTRIACA	+	+	1
TOMENTHYPNUM NITENS	20.9	13.1	7
TORTELLA ARCTICA	+	+	1
UNKNOWN MOSS	0.6	0.9	6
ALECTORIA NIGRICANS	+	+	2
CALOPLACA SP.	+	+	2
CETRARIA CUCULLATA	0.3	0.4	5
CETRARIA ISLANDICA	0.9	0.9	6
CETRARIA NIVALIS	0.2	0.4	2
CETRARIA RICHARDSONII	+	+	3
CLADONIA GRACILIS	+	+	1
CLADONIA POCILLUM	0.1	0.1	2
CLADONIA SP.	+	+	1
DACTYLINA ARCTICA	0.9	1.8	6
LECANORA EPIBRYON	0.1	0.1	6
LEPTOGIUM SINNUATUM	+	+	1
LOPADIUM FECUNDUM	0.1	0.1	2
OCHROLECHIA FRIGIDA TELEPHOROIDES	+	+	1
PELTIGERA APHTHOSA	0.1	0.2	3
PELTIGERA CANINA S.L.	0.1	0.1	4
PSOROMA HYPNORUM	+	+	1
SOLORINA SP.	0.1	0.1	5
STEREOCAULON ALPINUM	+	+	1
THAMNOLIA SUBULIFORMIS	3.8	3.0	7
UNKNOWN FRUTICOSE LICHEN	+	+	1
NOSTOC SP.	+	+	2

Table C2 (cont'd).

STAND TYPE U4
NUMBER OF PLOTS 5
PLOT NUMBERS 030A 030B 0303 1409 1514

TAXON	MEAN PCT COVER	STAND DEV	N
CAREX AQUATILIS S.L.	24.4	17.8	4
CAREX ATROFUSCA	0.5	1.1	1
CAREX BIGELOWII	0.3	0.8	1
CAREX MARINA	0.2	0.3	2
CAREX MISANDRA MISANDRA	0.2	0.4	2
CAREX ROTUNDATA	+	+	1
DRYAS INTEGRIFOLIA INTEGRIFOLIA	19.3	12.8	5
DUPONTIA FISHERI S.L.	+	+	1
EQUISETUM VARIEGATUM	0.8	0.8	4
ERIOPHORUM ANGUSTIFOLIUM S.L.	16.4	12.7	5
ERIOPHORUM RUSSEOLUM	+	+	1
HIEROCHLOE PAUCIFLORA	+	+	1
JUNCUS BIGLUMIS	+	+	1
PAPAVER MACOUNII	0.2	0.4	1
PEDICULARIS CAPITATA	+	+	1
PEDICULARIS SUDETICA S. L.	0.1	0.2	3
POA ARCTICA	+	+	1
POLYGONUM VIVIPARUM	0.3	0.3	4
PYROLA GRANDIFLORA	0.2	0.4	1
SALIX ARCTICA	4.1	4.9	4
SALIX LANATA RICHARDSONII	1.9	3.4	3
SALIX OVALIFOLIA OVALIFOLIA	0.2	0.4	1
SALIX PLANIFOLIA PULCHRA PULCHRA	0.6	1.3	1
SALIX RETICULATA RETICULATA	6.3	5.0	5
SALIX ROTUNDIFOLIA ROTUNDIFOLIA	+	+	1
SAXIFRAGA HIRCULUS PROPINQUA	+	+	1
SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	+	+	2
SENECIO ATROPURPUREUS FRIGIDUS	+	+	2
SILENE WAHLBERGELLA ARCTICA	+	+	1
STELLARIA LAETA	+	+	1
UNKNOWN DICOT	+	+	1
ANEURA PINGUIS	+	+	1
BLEPHAROSTOMA TRICHOPHYLLUM BREVIRETE	+	+	2
CALYPOGEIA MUELLERIANA	+	+	1
HARPANTHUS FLOTOWIANUS	+	+	1
LOPHOZIA BINSTEADII	0.2	0.4	1
LOPHOZIA SP.	+	+	1
PLAGIOCHILA ARCTICA	0.7	1.6	2
PTILIDIUM CILIARE	6.0	13.4	1
AULACOMNIUM TURGIDUM	+	+	1
BRACHYTHECIACEAE	1.2	2.2	3
BRACHYTHECIUM TURGIDUM	0.2	0.4	1
BRYUM ALGOVICUM	+	+	1
BRYUM SP.	0.6	0.9	3
CALLIERGON RICHARDSONII ROBUSTUM	0.8	0.5	4
CAMPYLIUM STELLATUM	7.6	7.2	3
CATOSCOPIUM NIGRITUM	0.9	1.3	4
CINCLIDIUM ARCTICUM	0.7	1.2	2
CINCLIDIUM LATIFOLIUM	+	+	1
CINCLIDIUM SP.	+	+	1
CIRRIPHYLLUM CIRROSUM	1.0	2.2	1
CRATONEURON ARCTICUM	0.5	1.1	2
DICRANUM ANGUSTUM	1.0	2.2	1
DISTICHIUM CAPILLACEUM	5.7	5.2	5
DITRICHUM FLEXICAULE	2.5	2.3	5
DREPANOCLADUS LYCOPODIOIDES BREVIFOLIUS	11.7	7.6	4
DREPANOCLADUS REVOLVENS	+	+	1
DREPANOCLADUS UNCINATUS	0.8	1.3	2
ENCALYPTA ALPINA	0.4	0.9	2
ENCALYPTA PROCERA	+	+	1
ENCALYPTA SP.	+	+	1
FISSIDENS SP.	+	+	1
HYLOCOMIUM SPLENDENS OBTUSIFOLIUM	4.0	8.9	1
HYPNUM BAMBERGERI	0.4	0.9	1
HYPNUM SP.	0.2	0.3	2
MEESIA ULIGINOSA	0.4	0.7	2
MNIUM BLYTTII	+	+	1
MYURELLA JULACEA	+	+	1
ONCOPHORUS WAHLENBERGII	+	+	1
ORTHOTHECIUM CHRYSEUM	1.9	3.0	4
POLITRICHASTRUM ALPINUM	0.4	0.9	1
RHYTIDIUM RUGOSUM	0.2	0.4	1
SCORPIDIUM TURGESCENS	+	+	1
TIMMIA AUSTRIACA	+	+	2
TOMENTHYPNUM NITENS	14.7	14.5	5
TORTELLA ARCTICA	0.4	0.9	3
VOITIA HYPERBOREA	+	+	1
UNKNOWN MOSS	1.0	0.9	4
CETRARIA CUCULLATA	+	+	1
CETRARIA ISLANDICA	0.4	0.7	3
CETRARIA RICHARDSONII	+	+	1
CLADONIA GRACILIS	+	+	1
CLADONIA POCILLUM	+	+	1
CLADONIA SP.	+	+	1
DACTYLINA ARCTICA	0.1	0.1	4
PELTIGERA APHTHOSA	+	+	2
PELTIGERA CANINA S.L.	+	+	1
PERTUSARIA DACTYLINA	+	+	1
SOLORINA SP.	+	+	1
THAMNOLIA SUBULIFORMIS	0.4	0.5	3
UNKNOWN CRUSTOSE LICHEN	0.1	0.2	1
NOSTOC COMMUNE	+	+	1
NOSTOC SP.	+	+	1

STAND TYPE U6
NUMBER OF PLOTS 3
PLOT NUMBERS 0901 1416 1509

TAXON	MEAN PCT COVER	STAND DEV	N
ANEMONE PARVIFLORA	0.3	0.6	1
ASTRAGALUS ALPINUS	0.7	1.2	1
ASTRAGALUS UMBELLATUS	1.7	2.0	3
CARDAMINE DIGITATA	0.1	0.0	3
CAREX RUPESTRIS	0.1	0.2	1
CAREX SCIRPOIDEA	3.1	2.7	2
CASSIOPE TETRAGONA TETRAGONA	36.9	14.0	3
CHRYSANTHEMUM INTEGRIFOLIUM	0.2	0.2	2
DRABA ALPINA	+	+	1
DRYAS INTEGRIFOLIA INTEGRIFOLIA	25.5	6.1	3
EQUISETUM ARVENSE	0.1	0.1	2
EQUISETUM VARIEGATUM	0.2	0.3	2
KOBRESIA MYOSUROIDES	+	+	1
LLOYDIA SEROTINA	0.7	1.1	2
LUZULA ARCTICA	+	+	1
MINUARTIA ARCTICA	+	+	1
PAPAVER MACOUNII	0.1	0.2	2
PARRYA NUDICAULIS NUDICAULIS	+	+	1
PEDICULARIS CAPITATA	1.0	1.7	1
PEDICULARIS LANATA	0.1	0.1	2
POA SP.	0.7	1.2	1
POLYGONUM VIVIPARUM	0.1	0.1	2
SALIX RETICULATA RETICULATA	4.9	3.8	3
SALIX ROTUNDIFOLIA ROTUNDIFOLIA	2.4	3.4	2
SAUSSUREA ANGUSTIFOLIA	0.1	0.1	2
SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	0.4	0.8	1
SENECIO ATROPURPUREUS FRIGIDUS	0.4	0.6	2
SILENE ACAULIS	1.3	2.3	1
UNKNOWN MONOCOT	+	+	1
UNKNOWN DICOT	0.1	0.1	2
BLEPHAROSTOMA TRICHOPHYLLUM BREVIRETE	+	+	1
PLAGIOCHILA ARCTICA	0.1	0.1	2
AULACOMNIUM PALUSTRE	1.3	2.3	1
BRYUM SP.	0.7	1.1	2
CAMPYLIUM STELLATUM	+	+	1
CRATONEURON ARCTICUM	+	+	1
DICRANUM ANGUSTUM	0.3	0.6	1
DISTICHIUM CAPILLACEUM	0.7	1.3	1
DITRICHUM FLEXICAULE	8.9	11.3	2
DREPANOCLADUS UNCINATUS	1.3	1.5	2
DREPANOCLADUS SP.	0.9	1.5	1
ENCALYPTA ALPINA	+	+	1
ENCALYPTA PROCERA	+	+	1
HYPNUM PROCERRIMUM	1.3	1.4	2
RHYTIDIUM RUGOSUM	+	+	1
THUIDIUM ABIETINUM	1.3	0.6	3
TIMMIA AUSTRIACA	0.1	0.1	2
TOMENTHYPNUM NITENS	2.0	2.7	2
TORTULA RURALIS	0.4	0.8	1
UNKNOWN MOSS	1.0	1.0	3
CALOPLACA SP.	+	+	1
CETRARIA CUCULLATA	1.7	2.9	1
CETRARIA DELISEI	0.2	0.3	1
CETRARIA ISLANDICA	1.4	1.5	2
CETRARIA NIVALIS	0.4	0.6	2
CETRARIA RICHARDSONII	1.0	1.7	2
CLADONIA POCILLUM	0.3	0.6	1
CLADONIA SP.	+	+	1
DACTYLINA ARCTICA	0.6	0.6	2
LECANORA EPIBRYON	2.3	4.0	1
LOPADIUM FECUNDUM	0.1	0.1	1
PELTIGERA APHTHOSA	1.7	2.9	1
PELTIGERA CANINA S.L.	0.4	0.5	3
PHYSCONIA MUSCIGENA	0.3	0.6	1
SOLORINA SP.	0.1	0.1	2
THAMNOLIA SUBULIFORMIS	0.1	0.1	2
UNKNOWN CRUSTOSE LICHEN	0.1	0.2	2

Table C2 (cont'd). Species data summaries of all stand types.

STAND TYPE U7
NUMBER OF PLOTS 2
PLOT NUMBERS 0902 1417

TAXON	MEAN PCT COVER	STAND DEV	N
ALOPECURUS ALPINUS ALPINUS	0.1	0.1	1
ARCTAGROSTIS LATIFOLIA S L	1.2	0.3	2
CARDAMINE DIGITATA	0.1	0.0	2
CAREX AQUATILIS S L	3.8	5.4	1
CAREX ROTUNDATA	0.1	0.1	1
CHRYSANTHEMUM INTEGRIFOLIUM	0.1	0.1	1
DRYAS INTEGRIFOLIA INTEGRIFOLIA	0.9	0.1	2
EQUISETUM ARVENSE	13.4	18.9	1
EQUISETUM SCIRPOIDES	1.9	2.7	1
EQUISETUM VARIEGATUM	0.5	0.7	1
ERIOPHORUM ANGUSTIFOLIUM S L	3.3	1.8	2
EUTREMA EDWARDSII	0.1	0.1	1
MINUARTIA ARCTICA	0.1	0.1	1
PARRYA NUDICAULIS NUDICAULIS	0.1	0.1	1
PEDICULARIS SUDETICA S L	0.1	0.1	1
POLYGONUM VIVIPARUM	0.3	0.4	2
SALIX RETICULATA RETICULATA	5.4	7.6	1
SALIX ROTUNDIFOLIA ROTUNDIFOLIA	30.3	42.0	2
SAXIFRAGA HIRCULUS PROPINQUA	0.1	0.1	1
SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	0.5	0.7	1
SENECIO ATROPURPUREUS FRIGIDUS	6.0	8.5	1
BLEPHAROSTOMA TRICHOPHYLLUM BREVIRETE	0.5	0.7	1
LOPHOZIA SP	0.1	0.1	1
PLAGIOCHILA ARCTICA	4.0	5.7	1
UNKNOWN LEAFY LIVERWORTS	3.2	3.2	2
AULACOMNIUM TURGIDUM	0.1	0.1	1
BRACHYTHECIACEAE	0.2	0.3	1
BRYUM SP	0.1	0.0	2
CAMPYLIUM STELLATUM	0.8	1.1	1
CATOSCOPIUM NIGRITUM	0.1	0.1	1
CINCLIDIUM ARCTICUM	0.4	0.6	1
CINCLIDIUM SP	0.5	0.7	1
DISTICHIUM CAPILLACEUM	8.2	10.3	2
DITRICHUM FLEXICAULE	8.0	11.3	1
DREPANOCLADUS UNCINATUS	4.8	0.2	2
ENCALYPTA ALPINA	0.7	1.0	1
ENCALYPTA PROCERA	0.1	0.1	1
ENCALYPTA SP	0.1	0.1	1
HYPNUM SP	0.1	0.1	1
ORTHOTHECIUM CHRYSEUM	0.1	0.1	1
TIMMIA NORVEGICA	0.3	0.4	1
TOMENTHYPNUM NITENS	51.0	41.0	2
TORTELLA ARCTICA	0.8	1.1	1
UNKNOWN MOSS	1.0	0.0	2
CETRARIA DELISEI	0.5	0.7	1
CETRARIA ISLANDICA	0.1	0.1	1
CETRARIA NIVALIS	0.1	0.1	1
CLADONIA SP	0.1	0.1	1
DACTYLINA RAMULOSA	0.1	0.1	1
PELTIGERA CANINA S L	0.1	0.1	1
STEREOCAULON ALPINUM	0.5	0.7	1
NOSTOC SP	0.1	0.1	1

STAND TYPE U8
NUMBER OF PLOTS 1
PLOT NUMBERS 1103

TAXON	MEAN PCT COVER	STAND DEV	N
CAREX AQUATILIS S L	30.0	0.0	1
EQUISETUM VARIEGATUM	10.0	0.0	1
ERIOPHORUM ANGUSTIFOLIUM S L	5.0	0.0	1
PEDICULARIS SUDETICA S L	1.0	0.0	1
POLYGONUM VIVIPARUM	1.0	0.0	1
SALIX LANATA RICHARDSONII	75.0	0.0	1
SALIX OVALIFOLIA OVALIFOLIA	2.0	0.0	1
SALIX RETICULATA RETICULATA	0.1	0.0	1
BRYUM SP	10.0	0.0	1
CALLIERGON RICHARDSONII ROBUSTUM	5.0	0.0	1
CAMPYLIUM STELLATUM	15.0	0.0	1
CINCLIDIUM ARCTICUM	2.0	0.0	1
CRATONEURON ARCTICUM	0.1	0.0	1
DISTICHIUM CAPILLACEUM	5.0	0.0	1
DREPANOCLADUS LYCOPODIOIDES BREVIFOLIUS	5.0	0.0	1
ORTHOTHECIUM CHRYSEUM	0.1	0.0	1
UNKNOWN MOSS	0.1	0.0	1

STAND TYPE U9
NUMBER OF PLOTS 1
PLOT NUMBERS 1102

TAXON	MEAN PCT COVER	STAND DEV	N
ASTRAGALUS UMBELLATUS	0.9	0.0	1
CARDAMINE DIGITATA	0.1	0.0	1
CAREX MISANDRA MISANDRA	0.1	0.0	1
CAREX ROTUNDATA	4.6	0.0	1
CAREX RUPESTRIS	0.1	0.0	1
CAREX SCIRPOIDEA	0.6	0.0	1
CASSIOPE TETRAGONA TETRAGONA	0.1	0.0	1
CHRYSANTHEMUM INTEGRIFOLIUM	0.1	0.0	1
DRABA ALPINA	0.1	0.0	1
DRYAS INTEGRIFOLIA INTEGRIFOLIA	44.2	0.0	1
EQUISETUM VARIEGATUM	0.1	0.0	1
EUTREMA EDWARDSII	0.1	0.0	1
JUNCUS BIGLUMIS	0.1	0.0	1
LLOYDIA SEROTINA	0.1	0.0	1
MINUARTIA ARCTICA	0.3	0.0	1
PAPAVER MACOUNII	0.5	0.0	1
PARRYA NUDICAULIS NUDICAULIS	0.1	0.0	1
PEDICULARIS CAPITATA	0.1	0.0	1
POLYGONUM VIVIPARUM	0.1	0.0	1
SALIX ARCTICA	1.0	0.0	1
SALIX RETICULATA RETICULATA	1.5	0.0	1
SALIX ROTUNDIFOLIA ROTUNDIFOLIA	5.6	0.0	1
SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	1.6	0.0	1
SENECIO ATROPURPUREUS FRIGIDUS	0.6	0.0	1
SENECIO RESEDIFOLIUS	0.2	0.0	1
UNKNOWN DICOT	0.1	0.0	1
LOPHOZIA SP	0.1	0.0	1
PLAGIOCHILA ARCTICA	0.1	0.0	1
BRYUM SP	0.1	0.0	1
CAMPYLIUM STELLATUM	0.1	0.0	1
DIDYMODON ASPERIFOLIUS	13.5	0.0	1
DISTICHIUM CAPILLACEUM	9.5	0.0	1
DITRICHUM FLEXICAULE	34.5	0.0	1
DREPANOCLADUS UNCINATUS	6.0	0.0	1
ENCALYPTA ALPINA	0.1	0.0	1
HYPNUM PROCERRIMUM	0.2	0.0	1
HYPNUM REVOLUTUM	5.0	0.0	1
ORTHOTHECIUM CHRYSEUM	0.1	0.0	1
TOMENTHYPNUM NITENS	19.8	0.0	1
TORTELLA ARCTICA	1.5	0.0	1
TORTULA RURALIS	3.9	0.0	1
UNKNOWN MOSS	0.1	0.0	1
CETRARIA CUCULLATA	0.1	0.0	1
CETRARIA DELISEI	0.1	0.0	1

Table C2 (cont'd).

STAND TYPE U10
NUMBER OF PLOTS 4
PLOT NUMBERS 1002 1418 1422 1502

TAXON	MEAN PCT COVER	STAND DEV	N
ALOPECURUS ALPINUS ALPINUS	3.7	7.5	1
ANDROSACE CHAMAEJASME LEHMANNIANA	+	+	1
ANDROSACE SEPTENTRIONALIS	0.5	1.0	2
ARCTAGROSTIS LATIFOLIA S.L.	3.0	5.3	3
ASTRAGALUS ALPINUS	0.3	0.5	1
BROMUS PUMPELLIANUS ARCTICUS	0.3	0.5	1
CARDAMINE DIGITATA	0.3	0.5	1
CAREX BIGELOWII	6.0	12.0	1
CERASTIUM BEERINGIANUM BEERINGIANUM	3.2	2.9	3
DRABA SP.	+	+	1
DRYAS INTEGRIFOLIA INTEGRIFOLIA	11.5	22.3	3
FESTUCA BAFFINENSIS	1.2	1.9	2
FESTUCA RUBRA	1.7	3.5	1
LLOYDIA SEROTINA	+	+	1
LUZULA CONFUSA	0.8	1.5	1
PAPAVER LAPPONICUM OCCIDENTALE	+	+	1
PAPAVER MACOUNII	0.8	1.5	1
PARRYA NUDICAULIS NUDICAULIS	0.8	1.5	1
PEDICULARIS CAPITATA	3.5	7.0	1
POA ALPIGENA	22.5	22.2	3
POA GLAUCA	+	+	1
POLEMONIUM BOREALE	0.3	0.5	1
POLYGONUM VIVIPARUM	1.3	2.5	2
POTENTILLA UNIFLORA	5.0	6.9	3
RANUNCULUS PEDATIFIDUS AFFINIS	0.5	1.0	2
SAGINA INTERMEDIA	+	+	1
SALIX RETICULATA RETICULATA	3.7	7.5	1
SALIX ROTUNDIFOLIA ROTUNDIFOLIA	22.0	38.7	3
SAUSSUREA ANGUSTIFOLIA	3.7	7.5	1
SAXIFRAGA CAESPITOSA	0.8	1.5	1
SAXIFRAGA HIERACIFOLIA	+	+	1
SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	0.5	1.0	1
SENECIO ATROPURPUREUS FRIGIDUS	+	+	1
STELLARIA LAETA	0.8	1.5	1
TARAXACUM PHYMATOCARPUM	1.0	2.0	1
UNKNOWN MONOCOT	1.2	2.5	1
UNKNOWN DICOT	0.1	0.1	2
ANASTROPHYLLUM MINUTUM	+	+	1
UNKNOWN LEAFY LIVERWORTS	0.1	0.1	2
AULACOMNIUM ACUMINATUM	1.2	2.5	1
AULACOMNIUM PALUSTRE	+	+	1
BRYUM ARCTICUM	+	+	1
BRYUM STENOTRICHUM	+	+	1
BRYUM SP.	4.7	6.9	3
CALLIERGON SP.	0.3	0.5	1
CERATODON PURPUREUS	+	+	1
CRATONEURON ARCTICUM	+	+	1
DICRANUM ANGUSTUM	0.5	1.0	1
DICRANUM ELONGATUM	0.5	1.0	1
DREPANOCLADUS UNCINATUS	1.2	2.5	1
ENCALYPTA SP.	0.1	0.1	2
FUNARIA ARCTICA	+	+	1
HYLOCOMIUM SPLENDENS OBTUSIFOLIUM	0.8	1.5	1
LEPTOBRYUM PYRIFORME	+	+	1
MEESIA ULIGINOSA	+	+	1
MNIUM BLYTTII	+	+	1
ONCOPHORUS WAHLENBERGII	+	+	1
POLITRICHASTRUM ALPINUM	0.3	0.5	2
RHACOMITRIUM LANUGINOSUM	0.3	0.5	1
RHYTIDIUM RUGOSUM	1.0	2.0	1
STEGONIA LATIFOLIA PILIFERA	+	+	1
THUIDIUM ABIETINUM	5.7	9.6	2
TIMMIA AUSTRIACA	0.3	0.5	2
TOMENTHYPNUM NITENS	0.5	1.0	2
TORTULA RURALIS	3.8	7.5	2
UNKNOWN MOSS	0.6	1.0	3
CETRARIA CUCULLATA	+	+	1
CETRARIA ISLANDICA	0.1	0.1	2
CLADONIA SP.	+	+	1
DACTYLINA ARCTICA	+	+	1
EVERNIA PERFRAGILIS	0.1	0.1	2
LECANORA EPIBRYON	+	+	1
LOPADIUM FECUNDUM	+	+	1
PELTIGERA APHTHOSA	0.5	1.0	2
PELTIGERA CANINA S.L.	+	+	1
THAMNOLIA SUBULIFORMIS	0.1	0.1	2

STAND TYPE U12
NUMBER OF PLOTS 2
PLOT NUMBERS 1303 1311

TAXON	MEAN PCT COVER	STAND DEV	N
CAREX AQUATILIS S.L.	30.5	17.7	2
DRABA LACTEA	0.5	0.7	1
DUPONTIA FISHERI S.L.	0.1	0.1	1
ERIOPHORUM ANGUSTIFOLIUM S.L.	28.0	31.2	2
HIEROCHLOE PAUCIFLORA	0.1	0.1	1
PETASITES FRIGIDUS	0.1	0.1	1
POA ARCTICA	0.6	0.6	2
POLYGONUM VIVIPARUM	0.1	0.1	1
SALIX ARCTICA	0.2	0.3	1
SALIX OVALIFOLIA OVALIFOLIA	0.8	1.1	1
SALIX PLANIFOLIA PULCHRA PULCHRA	17.5	3.5	2
SAXIFRAGA CERNUA	0.1	0.1	1
UNKNOWN LEAFY LIVERWORTS	0.4	0.6	1
AULACOMNIUM PALUSTRE	0.1	0.1	1
AULACOMNIUM TURGIDUM	0.1	0.1	1
BRACHYTHECIACEAE	0.5	0.7	1
BRACHYTHECIUM GROENLANDICUM	0.1	0.1	1
BRYUM SP.	1.2	1.8	1
CALLIERGON SP.	0.2	0.3	1
CAMPYLIUM STELLATUM	5.1	7.2	1
CINCLIDIUM ARCTICUM	0.1	0.1	1
DICRANUM ANGUSTUM	1.0	1.4	1
DICRANUM ELONGATUM	7.5	10.6	1
DISTICHIUM CAPILLACEUM	2.2	3.2	1
DREPANOCLADUS LYCOPODIOIDES BREVIFOLIUS	0.1	0.1	1
DREPANOCLADUS SP.	0.5	0.7	1
HYPNUM SP.	0.1	0.1	1
MNIUM RUGICUM	0.1	0.1	1
ONCOPHORUS WAHLENBERGII	0.1	0.1	1
POLITRICHASTRUM ALPINUM	7.1	9.8	2
POHLIA SP.	0.1	0.1	1
TOMENTHYPNUM NITENS	1.0	1.4	1
CETRARIA ISLANDICA	0.1	0.0	2
CLADONIA GRACILIS	0.1	0.1	1
CLADONIA PHYLLOPHORA	0.1	0.0	2
CLADONIA POCILLUM	0.1	0.1	1
DACTYLINA ARCTICA	1.0	1.4	1
OCHROLECHIA FRIGIDA	0.1	0.1	1
PELTIGERA APHTHOSA	0.1	0.1	1
PELTIGERA CANINA S.L.	0.1	0.1	1
SOLORINA SP.	0.1	0.1	1
SPHAEROPHORUS GLOBOSUS	0.1	0.1	1
THAMNOLIA SUBULIFORMIS	1.0	1.3	2

STAND TYPE U13
NUMBER OF PLOTS 1
PLOT NUMBERS 1309

TAXON	MEAN PCT COVER	STAND DEV	N
COCHLEARIA OFFICINALIS ARCTICA	0.2	0.0	1
DUPONTIA FISHERI S.L.	43.0	0.0	1
ERIOPHORUM ANGUSTIFOLIUM S.L.	0.1	0.0	1
PUCCINELLIA ANDERSONII	1.3	0.0	1
SALIX OVALIFOLIA OVALIFOLIA	0.1	0.0	1
STELLARIA HUMIFUSA	0.7	0.0	1
UNKNOWN MOSS	0.1	0.0	1

STAND TYPE U14
NUMBER OF PLOTS 2
PLOT NUMBERS 1204 1210

TAXON	MEAN PCT COVER	STAND DEV	N
ALOPECURUS ALPINUS ALPINUS	2.0	2.8	1
ARCTAGROSTIS LATIFOLIA S.L.	0.1	0.1	1
CAREX AQUATILIS S.L.	24.7	0.4	2
CAREX SCIRPOIDEA	0.1	0.1	1
DRYAS INTEGRIFOLIA INTEGRIFOLIA	7.9	0.1	2
EQUISETUM VARIEGATUM	1.1	1.3	2
ERIOPHORUM ANGUSTIFOLIUM S.L.	0.1	0.1	1
PEDICULARIS CAPITATA	0.1	0.1	1
POA SP.	1.0	1.4	1
POLYGONUM VIVIPARUM	1.6	0.6	2
SALIX ARCTICA	0.1	0.1	1
SALIX LANATA RICHARDSONII	0.1	0.1	1
SALIX OVALIFOLIA OVALIFOLIA	0.9	0.1	2
SALIX RETICULATA RETICULATA	0.1	0.1	1
SAXIFRAGA HIRCULUS PROPINQUA	0.1	0.1	1
STELLARIA LAETA	0.6	0.5	2
UNKNOWN MONOCOT	0.5	0.7	1
BRYUM SP.	0.1	0.1	1
CAMPYLIUM STELLATUM	0.1	0.0	2
CATOSCOPIUM NIGRITUM	0.1	0.1	1
DISTICHIUM CAPILLACEUM	0.1	0.1	1
ENCALYPTA SP.	0.1	0.0	2
UNKNOWN MOSS	0.1	0.1	1

Table C2 (cont'd). Species data summaries of all stand types.

STAND TYPE M1
NUMBER OF PLOTS 4
PLOT NUMBERS 1404 1407 1414 1420

TAXON	MEAN PCT COVER	STAND DEV	N
CAREX AQUATILIS S.L.	12.1	11.6	3
CAREX ATROFUSCA	0.1	0.1	2
CAREX MISANDRA MISANDRA	2.2	3.9	2
CAREX RARIFLORA	14.8	14.0	4
CAREX ROTUNDATA	0.8	1.6	1
CAREX SUBSPATHACEA	0.9	1.1	3
CHRYSANTHEMUM INTEGRIFOLIUM	+	+	1
DRABA LACTEA	+	+	1
DRYAS INTEGRIFOLIA INTEGRIFOLIA	+	+	1
EQUISETUM VARIEGATUM	0.1	0.1	3
ERIOPHORUM ANGUSTIFOLIUM S.L.	2.0	2.2	3
ERIOPHORUM RUSSEOLUM	0.8	0.9	3
JUNCUS BIGLUMIS	0.1	0.1	2
PEDICULARIS SUDETICA S. L.	0.6	0.4	4
POLYGONUM VIVIPARUM	0.1	0.1	3
SALIX ARCTICA	0.1	0.1	3
SALIX OVALIFOLIA OVALIFOLIA	+	+	1
SALIX PLANIFOLIA PULCHRA PULCHRA	0.1	0.3	1
SALIX RETICULATA RETICULATA	0.1	0.1	2
SAXIFRAGA FOLIOLOSA	0.2	0.2	3
SAXIFRAGA HIRCULUS PROPINQUA	0.4	0.4	3
SILENE WAHLBERGELLA ARCTICA	0.1	0.1	2
UNKNOWN DICOT	+	+	1
UNKNOWN LEAFY LIVERWORTS	0.1	0.1	1
AULACOMNIUM TURGIDUM	+	+	1
BRACHYTHECIACEAE	+	+	1
BRYUM SP.	0.3	0.5	2
CALLIERGON RICHARDSONII ROBUSTUM	+	+	1
CALLIERGON SP.	0.3	0.6	1
CAMPYLIUM STELLATUM	0.3	0.5	2
CINCLIDIUM ARCTICUM	0.2	0.3	1
CINCLIDIUM STYGIUM	+	+	1
CINCLIDIUM SP.	+	+	1
DISTICHIUM CAPILLACEUM	+	+	1
DITRICHUM FLEXICAULE	+	+	1
DREPANOCLADUS LYCOPODIOIDES BREVIFOLIUS	21.0	16.8	4
FISSIDENS SP.	+	+	1
MEESIA TRIQUETRA	+	+	1
MNIUM BLYTTII	+	+	1
ONCOPHORUS WAHLENBERGII	+	+	1
ORTHOTHECIUM CHRYSEUM	0.1	0.2	1
POLYTRICHACEAE	+	+	1
RHYTIDIUM RUGOSUM	0.1	0.1	1
SCORPIDIUM SCORPIOIDES	19.5	37.0	2
SPLACHNUM VASCULOSUM	+	+	1
UNKNOWN MOSS	0.5	0.6	3
CLADONIA GRACILIS	+	+	1
CLADONIA SQUAMOSA	+	+	1
DACTYLINA ARCTICA	+	+	1
LECANORA EPIBRYON	+	+	1
SOLORINA SP.	+	+	1
THAMNOLIA SUBULIFORMIS	+	+	1
NOSTOC COMMUNE	1.6	2.2	2

STAND TYPE M2
NUMBER OF PLOTS 8
PLOT NUMBERS 040A 040B 1304 1308 1501 1503 1511 1516

TAXON	MEAN PCT COVER	STAND DEV	N
CAREX AQUATILIS S.L.	33.4	26.1	8
CAREX ATROFUSCA	0.4	0.7	5
CAREX MARINA	0.2	0.6	3
CAREX MEMBRANACEA	0.2	0.4	1
CAREX MISANDRA MISANDRA	+	+	3
CAREX RARIFLORA	0.1	0.4	2
CAREX ROTUNDATA	0.7	1.1	5
CAREX SAXATILIS LAXA	0.6	1.0	4
CAREX VAGINATA	+	+	1
CAREX SP.	0.3	0.6	4
DRYAS INTEGRIFOLIA INTEGRIFOLIA	0.1	0.1	4
DUPONTIA FISHERI S.L.	0.2	0.3	6
EQUISETUM VARIEGATUM	0.8	1.5	6
ERIOPHORUM ANGUSTIFOLIUM S.L.	6.3	7.1	7
ERIOPHORUM RUSSEOLUM	0.2	0.3	4
HIEROCHLOE PAUCIFLORA	0.1	0.4	1
JUNCUS BIGLUMIS	0.1	0.1	4
PEDICULARIS SUDETICA INTERIOR	0.1	0.2	1
PEDICULARIS SUDETICA S. L.	0.6	0.7	5
POLYGONUM VIVIPARUM	0.1	0.1	6
SALIX ARCTICA	0.7	1.3	7
SALIX LANATA RICHARDSONII	0.1	0.1	3
SALIX OVALIFOLIA OVALIFOLIA	1.2	3.2	5
SALIX RETICULATA RETICULATA	0.1	0.1	4
SAXIFRAGA HIRCULUS PROPINQUA	0.2	0.3	4
SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	+	+	3
SILENE WAHLBERGELLA ARCTICA	+	+	1
UNKNOWN DICOT	+	+	1
ANEURA PINGUIS	0.1	0.2	3
BLEPHAROSTOMA TRICHOPHYLLUM BREVIRETE	0.3	0.7	1
UNKNOWN LEAFY LIVERWORTS	0.1	0.4	2
BRACHYTHECIACEAE	+	+	1
BRYUM SP.	0.6	0.8	7
CALLIERGON RICHARDSONII ROBUSTUM	3.2	2.2	6
CALLIERGON SP.	0.1	0.1	1
CAMPYLIUM STELLATUM	2.2	3.6	6
CATOSCOPIUM NIGRITUM	1.0	1.9	5
CINCLIDIUM ARCTICUM	2.3	6.4	3
CINCLIDIUM LATIFOLIUM	6.0	6.1	7
DISTICHIUM CAPILLACEUM	5.4	6.8	7
DITRICHUM FLEXICAULE	+	+	2
DREPANOCLADUS LYCOPODIOIDES BREVIFOLIUS	31.0	22.3	7
ENCALYPTA ALPINA	0.1	0.1	4
ENCALYPTA SP.	+	+	1
FISSIDENS SP.	+	+	1
MEESIA TRIQUETRA	3.6	5.7	4
MEESIA ULIGINOSA	0.6	1.4	3
MNIUM BLYTTII	+	+	1
ORTHOTHECIUM CHRYSEUM	0.9	2.1	4
SCORPIDIUM SCORPIOIDES	4.7	9.5	3
SCORPIDIUM TURGESCENS	+	+	1
TIMMIA AUSTRIACA	+	+	1
TIMMIA MEGAPOLITANA BAVARICA	+	+	1
TOMENTHYPNUM NITENS	0.1	0.4	2
TORTULA RURALIS	+	+	1
UNKNOWN MOSS	0.5	0.8	4
CETRARIA ISLANDICA	+	+	1
THAMNOLIA SUBULIFORMIS	+	+	1
NOSTOC COMMUNE	2.2	3.1	6

Table C2 (cont'd).

STAND TYPE M3
NUMBER OF PLOTS 2
PLOT NUMBERS 1203 1205

TAXON	MEAN PCT COVER	STAND DEV	N
CARDAMINE PRATENSIS ANGUSTIFOLIA	0.1	0.1	1
CAREX AQUATILIS S.L.	44.3	22.2	2
DRYAS INTEGRIFOLIA INTEGRIFOLIA	0.1	0.1	1
DUPONTIA FISHERI S.L.	4.0	4.3	2
EQUISETUM VARIEGATUM	6.4	9.1	1
PEDICULARIS SUDETICA S. L.	0.1	0.1	1
POLYGONUM VIVIPARUM	0.1	0.1	1
SALIX ARCTICA	0.1	0.1	1
SALIX LANATA RICHARDSONII	0.1	0.1	1
SALIX OVALIFOLIA OVALIFOLIA	1.0	1.3	2
SAXIFRAGA HIRCULUS PROPINQUA	0.1	0.1	1
UNKNOWN THALLOID LIVERWORTS	1.1	1.6	1
BRYUM SP	0.1	0.1	1
CALLIERGON RICHARDSONII ROBUSTUM	23.5	30.4	2
CAMPYLIUM STELLATUM	0.5	0.7	1
CATOSCOPIUM NIGRITUM	7.0	9.9	1
CINCLIDIUM ARCTICUM	0.5	0.7	1
CINCLIDIUM LATIFOLIUM	23.2	31.5	2
DISTICHIUM CAPILLACEUM	6.2	8.7	2
DREPANOCLADUS LYCOPODIOIDES BREVIFOLIUS	35.2	27.9	2
ENCALYPTA SP	0.1	0.1	1
MEESIA TRIQUETRA	0.3	0.4	1
MEESIA ULIGINOSA	0.1	0.1	1
UNKNOWN MOSS	0.6	0.6	2
NOSTOC COMMUNE	0.4	0.6	1

STAND TYPE M4
NUMBER OF PLOTS 4
PLOT NUMBERS 050A 050B 1413 1517

TAXON	MEAN PCT COVER	STAND DEV	N
CAREX AQUATILIS S.L.	40.5	17.0	4
CAREX ROTUNDATA	1.0	2.0	1
CAREX SAXATILIS LAXA	0.4	0.5	2
ERIOPHORUM ANGUSTIFOLIUM S.L.	2.4	2.6	4
ERIOPHORUM RUSSEOLUM	0.2	0.3	1
ERIOPHORUM SCHEUCHZERI SCHEUCHZERI	0.2	0.2	2
PEDICULARIS SUDETICA S. L.	0.3	0.5	2
CALLIERGON SP.	+	+	1
MEESIA TRIQUETRA	+	+	1
SCORPIDIUM SCORPIOIDES	28.0	25.2	3
NOSTOC COMMUNE	6.5	11.0	3

STAND TYPE M5
NUMBER OF PLOTS 2
PLOT NUMBERS 1101 1508

TAXON	MEAN PCT COVER	STAND DEV	N
BRAYA SP.	0.1	0.1	1
CAREX AQUATILIS S L.	48.3	31.3	2
CAREX ROTUNDATA	0.1	0.1	1
CAREX SP	0.1	0.1	1
DRYAS INTEGRIFOLIA INTEGRIFOLIA	0.1	0.1	1
DUPONTIA FISHERI S.L	1.0	1.5	1
EPILOBIUM LATIFOLIUM	0.1	0.1	1
EQUISETUM ARVENSE	0.2	0.2	1
EQUISETUM VARIEGATUM	0.6	0.8	2
ERIOPHORUM ANGUSTIFOLIUM S L.	4.9	2.8	2
ERIOPHORUM RUSSEOLUM	0.6	0.8	1
GENTIANELLA PROPINQUA PROPINQUA	0.1	0.1	1
JUNCUS BIGLUMIS	0.1	0.1	1
PEDICULARIS SUDETICA S L	0.6	0.8	1
POLYGONUM VIVIPARUM	0.2	0.0	2
SALIX ARCTICA	2.3	3.3	1
SALIX LANATA RICHARDSONII	0.5	0.7	1
SALIX OVALIFOLIA OVALIFOLIA	3.2	4.5	1
SALIX RETICULATA RETICULATA	5.7	8.0	2
SALIX ROTUNDIFOLIA ROTUNDIFOLIA	4.2	5.7	2
SAXIFRAGA HIRCULUS PROPINQUA	0.4	0.5	2
SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	0.1	0.1	1
STELLARIA LAETA	0.1	0.1	1
THALICTRUM ALPINUM	0.2	0.2	1
WILHELMSIA PHYSODES	0.1	0.1	1
UNKNOWN DICOT	0.5	0.6	2
UNKNOWN LEAFY LIVERWORTS	0.1	0.1	1
BRYUM SP	0.9	1.1	2
CALLIERGON RICHARDSONII ROBUSTUM	0.9	0.5	2
CALLIERGON SP	3.0	4.3	1
CAMPYLIUM STELLATUM	9.2	10.3	2
CATOSCOPIUM NIGRITUM	0.1	0.1	1
CINCLIDIUM LATIFOLIUM	1.4	2.0	1
DISTICHIUM CAPILLACEUM	1.4	2.0	1
DITRICHUM FLEXICAULE	0.1	0.1	1
DREPANOCLADUS LYCOPODIOIDES BREVIFOLIUS	2.3	2.5	2
ENCALYPTA ALPINA	0.2	0.1	2
MEESIA TRIQUETRA	2.5	3.5	1
ONCOPHORUS WAHLENBERGII	0.1	0.1	1
ORTHOTHECIUM CHRYSEUM	0.1	0.1	1
PHILONOTIS FONTANA PUMILA	2.0	2.8	1
UNKNOWN MOSS	0.1	0.0	2

STAND TYPE M7
NUMBER OF PLOTS 1
PLOT NUMBERS 1107

TAXON	MEAN PCT COVER	STAND DEV	N
ALOPECURUS ALPINUS ALPINUS	5.0	0.0	1
ANEMONE PARVIFLORA	0.1	0.0	1
ARCTAGROSTIS LATIFOLIA S.L	8.0	0.0	1
DESCHAMPSIA CAESPITOSA ORIENTALIS	0.1	0.0	1
DUPONTIA FISHERI S.L	1.0	0.0	1
EQUISETUM ARVENSE	35.0	0.0	1
EQUISETUM VARIEGATUM	1.0	0.0	1
JUNCUS CASTANEUS CASTANEUS	0.1	0.0	1
POLYGONUM VIVIPARUM	0.1	0.0	1
SALIX ARCTICA	1.0	0.0	1
SALIX OVALIFOLIA OVALIFOLIA	13.0	0.0	1
UNKNOWN MONOCOT	0.1	0.0	1
UNKNOWN DICOT	0.1	0.0	1
BRYUM SP	1.0	0.0	1
UNKNOWN MOSS	0.1	0.0	1

STAND TYPE M8
NUMBER OF PLOTS 1
PLOT NUMBERS 1306

TAXON	MEAN PCT COVER	STAND DEV	N
CAREX AQUATILIS S.L.	1.0	0.0	1
DUPONTIA FISHERI S.L.	80.0	0.0	1
ERIOPHORUM ANGUSTIFOLIUM S.L.	5.0	0.0	1
ERIOPHORUM SCHEUCHZERI SCHEUCHZERI	1.0	0.0	1
SALIX OVALIFOLIA OVALIFOLIA	7.0	0.0	1
SAXIFRAGA CERNUA	1.0	0.0	1
BRYUM TORTIFOLIUM	0.1	0.0	1
CALLIERGON SP.	1.0	0.8	1
CAMPYLIUM STELLATUM	20.0	0.0	1
MNIUM ANDREWSIANUM	0.1	0.0	1
UNKNOWN MOSS	1.0	0.0	1

STAND TYPE M9
NUMBER OF PLOTS 2
PLOT NUMBERS 1302 1318

TAXON	MEAN PCT COVER	STAND DEV	N
CAREX SUBSPATHACEA	75.2	14.5	2
PUCCINELLIA PHRYGANODES	15.8	20.1	2
STELLARIA HUMIFUSA	1.0	1.3	2
CAMPYLIUM STELLATUM	0.1	0.1	1
UNKNOWN MOSS	0.1	0.1	1

STAND TYPE M10
NUMBER OF PLOTS 1
PLOT NUMBERS 1310

TAXON	MEAN PCT COVER	STAND DEV	N
CAREX AQUATILIS S.L.	20.0	0.0	1
CAREX SP.	0.6	0.0	1
DUPONTIA FISHERI S.L	1.6	0.0	1
ERIOPHORUM ANGUSTIFOLIUM S.L.	6.2	0.0	1
HIEROCHLOE PAUCIFLORA	0.1	0.0	1
PEDICULARIS SUDETICA S. L.	0.1	0.0	1
SALIX OVALIFOLIA OVALIFOLIA	0.1	0.0	1
SAXIFRAGA CERNUA	0.1	0.0	1
STELLARIA LAETA	0.1	0.0	1
UNKNOWN LEAFY LIVERWORTS	0.1	0.0	1
BRYUM SP.	0.1	0.0	1
CAMPYLIUM STELLATUM	0.2	0.0	1
CRATONEURON ARCTICUM	0.1	0.0	1
DISTICHIUM CAPILLACEUM	0.1	0.0	1
DREPANOCLADUS LYCOPODIOIDES BREVIFOLIUS	3.4	0.0	1
ONCOPHORUS WAHLENBERGII	0.1	0.0	1
CLADONIA PHYLLOPHORA	0.1	0.0	1
THAMNOLIA SUBULIFORMIS	0.1	0.0	1
UNKNOWN CRUSTOSE LICHEN	0.1	0.0	1
NOSTOC COMMUNE	0.1	0.0	1

STAND TYPE M11
NUMBER OF PLOTS 1
PLOT NUMBERS 1209

TAXON	MEAN PCT COVER	STAND DEV	N
CAREX AQUATILIS S.L	38.0	0.0	1
DUPONTIA FISHERI S.L	8.2	0.0	1
SALIX OVALIFOLIA OVALIFOLIA	1.8	0.0	1
STELLARIA LAETA	0.1	0.0	1

Table C2 (cont'd). Species data summaries of all stand types.

STAND TYPE E1
NUMBER OF PLOTS 3
PLOT NUMBERS 1402 1408 1518

TAXON	MEAN PCT COVER	STAND DEV	N
CALTHA PALUSTRIS ARCTICA	+	+	1
CAREX AQUATILIS S.L.	24.7	6.1	3
ERIOPHORUM ANGUSTIFOLIUM S.L.	1.0	0.9	3
ERIOPHORUM RUSSEOLUM	0.3	0.6	1
ERIOPHORUM SCHEUCHZERI SCHEUCHZERI	1.7	1.5	2
RANUNCULUS PALLASII	0.2	0.3	1
UTRICULARIA VULGARIS MACRORHIZA	+	+	1
UNKNOWN FRUTICOSE LICHEN	+	+	1

STAND TYPE E2
NUMBER OF PLOTS 3
PLOT NUMBERS 060A 060B 1307

TAXON	MEAN PCT COVER	STAND DEV	N
ARCTOPHILA FULVA	24.8	5.0	3
CAREX AQUATILIS S.L.	1.7	2.1	2
UTRICULARIA VULGARIS MACRORHIZA	+	+	1
SCORPIDIUM SCORPIOIDES	0.5	0.9	1

STAND TYPE E3
NUMBER OF PLOTS 1
PLOT NUMBERS 1206

TAXON	MEAN PCT COVER	STAND DEV	N
SCORPIDIUM SCORPIOIDES	100.0	0.0	1

Table C3. Growth-form summaries for all stand types. The units are percentage of cover.

VEGETATION TYPE	GROWTH FORM CODE 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
B1	47.93	.28	.45	0	0	0	.27	3.25	.07	.02	5.52	.23	.17	1.30	0	.02
B2	51.23	.10	6.60	.17	0	0	1.50	1.00	0	.03	5.37	.63	.27	5.03	0	0
B3	18.00	0	.07	.03	0	0	.13	7.73	0	.07	8.33	.37	.07	1.90	0	.10
B4	0	0	0	.10	0	0	.05	1.25	0	0	.55	.65	1.05	4.75	0	.05
B5	38.00	0	.40	.90	0	0	1.80	.30	0	0	.50	0	.40	4.80	0	0
B6	42.10	0	8.70	0	.10	0	5.60	1.60	.10	.10	3.40	3.60	.80	4.70	0	.20
B7	0	0	2.00	1.00	0	0	0	.10	0	0	0	0	8.00	23.10	0	0
B8	0	0	0	0	0	0	.40	6.50	0	0	0	3.00	1.30	0	0	0
B9	0	0	0	0	0	0	0	3.40	0	0	0	0	0	.10	0	0
B10	0	0	0	0	0	.10	3.00	0	0	0	0	0	5.00	0	0	0
B11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B12	0	0	14.10	2.30	0	0	.50	3.20	0	0	0	0	.70	.60	0	0
B13	8.67	0	0	14.63	0	0	0	1.73	0	0	2.07	2.73	.67	5.50	0	.67
B14	75.00	0	20.00	0	0	0	.10	0	0	0	0	0	0	5.30	0	0
B15	1.50	0	2.20	2.60	0	0	3.70	4.60	0	0	0	0	.10	.10	0	0
U1	15.05	.03	2.17	.40	0	0	3.18	22.77	0	.03	.05	0	.15	.30	0	.08
U2	20.60	2.60	.50	.90	.10	0	9.50	22.80	0	.10	.10	.10	.20	.50	0	0
U3	32.27	.36	1.86	1.36	.04	.04	.63	30.99	0	.06	.73	.13	.16	.66	0	.17
U4	19.30	0	6.36	4.94	1.94	0	.76	41.44	0	.02	.04	0	.20	.74	0	.82
U5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U6	25.53	36.93	7.33	0	0	.03	3.20	.77	.70	.07	1.77	.70	.20	3.93	0	.30
U7	.90	0	35.70	0	0	0	0	8.45	0	0	.50	.10	.05	6.65	0	15.75
U8	0	0	.10	2.00	75.00	0	0	35.00	0	0	0	0	0	2.00	0	10.00
U9	44.20	.10	7.10	1.00	0	0	.80	9.50	.10	.10	1.60	.30	.20	2.70	0	.10
U10	11.52	0	25.75	0	0	1.25	2.02	37.27	.03	.05	5.50	3.50	2.38	11.85	0	0
U11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U12	0	0	0	18.45	0	0	0	59.10	0	0	0	0	.50	.15	0	0
U13	0	0	0	.10	0	0	1.30	43.10	0	0	0	.70	.20	0	0	0
U14	7.90	0	.05	.95	.05	.50	.05	27.85	0	0	0	0	0	2.35	0	1.10
U15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M1	.03	0	.05	.23	0	0	2.40	33.30	0	.03	0	0	.23	1.15	0	.08
M2	.06	0	.05	1.92	.06	0	.51	42.29	0	.01	.04	0	0	.99	0	.79
M3	.05	0	0	1.10	.05	0	0	48.25	0	0	0	0	0	.25	0	6.45
M4	0	0	0	0	0	0	0	44.63	0	0	0	0	0	.28	0	0
M5	.05	0	9.95	5.50	.50	0	.05	55.05	0	.50	.05	.05	.05	1.50	0	.80
M6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M7	0	0	0	14.00	0	.10	.10	14.10	0	.10	0	0	0	.20	0	36.00
M8	0	0	0	7.00	0	0	0	87.00	0	0	0	0	0	1.00	0	0
M9	0	0	0	0	0	0	0	91.05	0	0	0	1.05	0	0	0	0
M10	0	0	0	.10	0	0	0	28.50	0	0	0	0	0	.30	0	0
M11	0	0	0	1.80	0	0	0	46.20	0	0	0	0	0	.10	0	0
E1	0	0	0	0	0	0	0	27.67	0	0	0	0	0	.23	.03	0
E2	0	0	0	0	0	0	0	26.50	0	0	0	0	0	0	.03	0
E3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

1 EVERGREEN SHRUB LT 3CM
2 EVERGREEN SHRUB 10-30 CM
3 DECIDUOUS SHRUB LT 3CM
4 DECIDUOUS SHRUB 3-10CM
5 DECIDUOUS SHRUB 10-30CM
6 UNKNOWN MONOCOT
7 CEASPITOSE GRAMINOID MONO
8 SINGLE GRAMINOID MONOCOT
9 NON-GRAMINOID MONOCOT
10 UNKNOWN DICOTYLEDON
11 CUSHION DICOTYLEDON
12 MAT DICOTYLEDON
13 ROSETTE DICOTYLEDON
14 ERECT DICOTYLEDON
15 NON-ROOTED AQUATIC DICOT
16 HORSETAIL
17 UNKNOWN MOSS
18 PLEUROCARPOUS MOSS
19 ACROCARPOUS MOSS
20 LEAFY LIVERWORT
21 THALLOID LIVERWORT
22 CRUSTOSE LICHEN
23 FOLIOSE LICHEN
24 FRUTICOSE LICHEN
25 ALGA
26 = 11 + 12 ABOVE
27 = 13 + 14 ABOVE
28 = 18 + 19 ABOVE
29 = 20 + 21 ABOVE
30 = 23 + 24 ABOVE
31 DECIDUOUS SHRUB

Table C3 (cont'd). Growth-form summaries for all stand types.

VEGETATION TYPE	GROWTH FORM CODE 17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
B1	.08	3.17	2.23	.08	0	11.77	.55	4.92	0	5.75	1.47	5.40	.08	5.47	.45
B2	.47	5.20	14.53	.03	0	11.83	1.43	6.50	0	6.00	5.30	19.73	.03	7.93	6.77
B3	.03	10.77	4.63	0	0	9.40	.67	8.43	0	8.70	1.97	15.40	0	9.10	.10
B4	0	0	0	0	0	0	0	0	0	1.20	5.80	0	0	0	.10
B5	.40	0	0	0	0	1.30	0	0	0	.50	5.20	0	0	0	1.30
B6	1.50	6.20	24.60	0	.10	.40	0	.20	0	7.00	5.50	30.80	.10	.20	8.80
B7	0	0	.10	0	0	0	0	0	0	0	31.10	.10	0	0	3.00
B8	0	0	0	0	0	0	0	0	0	3.00	1.30	0	0	0	0
B9	0	0	0	0	0	0	0	0	0	0	.10	0	0	0	0
B10	1.00	.20	.20	0	0	3.10	0	3.00	0	0	5.00	.40	0	3.00	0
B11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B12	.10	.20	1.40	.10	0	22.40	.10	1.70	0	0	1.30	1.60	.10	1.80	16.40
B13	.67	0	9.00	0	0	.07	0	1.63	.03	4.80	6.17	9.00	0	1.63	14.63
B14	1.00	12.00	6.00	0	0	1.00	0	26.00	0	0	5.30	18.00	0	26.00	20.00
B15	.10	0	2.50	0	0	18.00	.20	1.50	0	0	.20	2.50	0	1.70	4.80
U1	2.65	13.35	13.48	3.30	.03	7.33	.28	12.35	0	.05	.45	26.83	3.33	12.63	2.58
U2	.30	68.00	31.00	1.00	0	.20	.50	10.30	.10	.20	.70	99.00	1.00	10.80	1.50
U3	.59	36.17	31.34	2.40	.03	.21	.26	6.29	.03	.86	.81	67.51	2.43	6.54	3.26
U4	.98	45.32	13.34	7.02	.02	.12	.08	.98	.04	.04	.94	58.66	7.04	1.06	13.24
U5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U6	1.03	8.27	11.20	.10	0	2.57	2.47	5.73	0	2.47	4.13	19.47	.10	8.20	7.33
U7	1.00	57.00	19.10	7.85	0	0	.05	1.20	.05	.60	6.70	76.10	7.85	1.25	35.70
U8	.10	25.20	17.00	0	0	0	0	0	0	0	2.00	42.20	0	0	77.10
U9	.10	31.20	63.10	.20	0	0	0	.20	0	1.90	2.90	94.30	.20	.20	8.10
U10	.55	11.07	10.35	.08	0	.05	.55	.23	0	9.00	14.22	21.42	.08	.77	25.75
U11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U12	0	7.55	19.25	.45	0	.05	.15	2.40	0	0	.65	26.80	.45	2.55	18.45
U13	.10	0	0	0	0	0	0	0	0	.70	.20	0	0	0	.10
U14	.05	.10	.25	0	0	0	0	0	0	0	2.35	.35	0	0	1.05
U15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M1	.52	41.30	.70	.05	0	.03	.03	.10	1.58	0	1.38	42.00	.05	.13	.28
M2	.51	42.21	19.64	.39	.09	0	0	.03	2.20	.04	.99	61.85	.47	.03	2.04
M3	.55	59.25	37.45	0	1.10	0	0	0	.40	0	.25	96.70	1.10	0	1.15
M4	0	28.02	.03	0	0	0	0	0	6.53	0	.28	28.05	0	0	0
M5	.10	15.55	8.55	.05	0	0	0	0	0	.10	1.55	24.10	.05	0	15.95
M6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M7	.10	0	1.00	0	0	0	0	0	0	0	.20	1.00	0	0	14.00
M8	1.00	21.00	.20	0	0	0	0	0	0	0	1.00	21.20	0	0	7.00
M9	.05	.05	0	0	0	0	0	0	0	1.05	0	.05	0	0	0
M10	0	3.70	.30	.10	0	.10	0	.20	.10	0	.30	4.00	.10	.20	.10
M11	0	0	0	0	0	0	0	0	0	0	.10	0	0	0	1.80
E1	0	0	0	0	0	0	0	.03	0	0	.23	0	0	.03	0
E2	0	.50	0	0	0	0	0	0	0	0	0	.50	0	0	0
E3	0	100.00	0	0	0	0	0	0	0	0	0	100.00	0	0	0

1 EVERGREEN SHRUB LT 3CM
2 EVERGREEN SHRUB 10-30 CM
3 DECIDUOUS SHRUB LT 3CM
4 DECIDUOUS SHRUB 3-10CM
5 DECIDUOUS SHRUB 10-30CM
6 UNKNOWN MONOCOT
7 CEASPITOSE GRAMINOID MONO
8 SINGLE GRAMINOID MONOCOT
9 NON-GRAMINOID MONOCOT
10 UNKNOWN DICOTYLEDON
11 CUSHION DICOTYLEDON
12 MAT DICOTYLEDON
13 ROSETTE DICOTYLEDON
14 ERECT DICOTYLEDON
15 NON-ROOTED AQUATIC DICOT
16 HORSETAIL
17 UNKNOWN MOSS
18 PLEUROCARPOUS MOSS
19 ACROCARPOUS MOSS
20 LEAFY LIVERWORT
21 THALLOID LIVERWORT
22 CRUSTOSE LICHEN
23 FOLIOSE LICHEN
24 FRUTICOSE LICHEN
25 ALGA
26 = 11 + 12 ABOVE
27 = 13 + 14 ABOVE
28 = 18 + 19 ABOVE
29 = 20 + 21 ABOVE
30 = 23 + 24 ABOVE
31 DECIDUOUS SHRUB

APPENDIX D. SUPPLEMENTARY FLORISTICS DATA

Table D1. Floristic classifications for the vascular flora.

SPECIES NAME	PHYSIOGRAPHIC UNIT	GEOGRAPHIC RANGE	NORTHERN LIMIT YOUNG'S ZONES
AGROPYRON BOREALE HYPERARCTICUM	ARCTIC	NORTH AMERICA	ZONE 2
ALOPECURUS ALPINUS ALPINUS	ARCTIC	CIRCUMPOLAR	ZONE 1
ANDROSACE CHAMAEJASME LEHMANNIANA	ARCTIC - ALPINE	W NORTH AMERICA, ASIA, EUROPE	ZONE 2
ANDROSACE SEPTENTRIONALIS	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
ANEMONE PARVIFLORA	ARCTIC - ALPINE	NORTH AMERICA	ZONE 3
ANEMONE RICHARDSONII	ARCTIC	NORTH AMERICA, ASIA	ZONE 3
ANTENNARIA FRIESIANA ALASKANA	ARCTIC	NORTH AMERICA, ASIA	ZONE 3
ARABIS LYRATA KAMCHATICA	ARCTIC - BOREAL	NORTH AMERICA, ASIA	ZONE 4
ARCTAGROSTIS LATIFOLIA ARUNDINACEAE	ARCTIC	NORTH AMERICA, ASIA	ZONE 3
ARCTAGROSTIS LATIFOLIA LATIFOLIA	ARCTIC	CIRCUMPOLAR	ZONE 1
ARCTOPHILA FULVA	ARCTIC	CIRCUMPOLAR	ZONE 2
ARCTOSTAPHYLOS RUBRA	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 3
ARMERIA MARITIMA ARCTICA	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 2
ARNICA ALPINA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 3
ARNICA FRIGIDA	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 3
ARTEMISIA ARCTICA ARCTICA	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 2
ARTEMISIA BOREALIS	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 3
ARTEMISIA GLOMERATA	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 3
ARTEMISIA TILESII TILESII	ARCTIC	NORTH AMERICA, ASIA	ZONE 2
ASTER SIBIRICUS	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 3
ASTRAGALUS ABORIGINUM	ARCTIC	NORTH AMERICA	ZONE 3
ASTRAGALUS ALPINUS	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
ASTRAGALUS UMBELLATUS	ARCTIC	NORTH AMERICA, ASIA	ZONE 2
BOYKINIA RICHARDSONII	ARCTIC	NORTH WEST AMERICA	ZONE 3
BRAYA PILOSA	COASTAL	NORTH AMERICA, ASIA	ZONE 3
BRAYA PURPURASCENS	ARCTIC	CIRCUMPOLAR	ZONE 2
BROMUS PUMPELLIANUS ARCTICUS	ARCTIC	NORTH AMERICA, ASIA	ZONE 3
BUPLEURUM TRIRADIATUM	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 3
CALAMOGROSTIS NEGLECTA	ARCTIC - BOREAL	CIRCUMPOLAR	ZONE 3
CALTHA PALUSTRIS ARCTICA	ARCTIC - ALPINE	W NORTH AMERICA, ASIA, EUROPE	ZONE 2
CAMPANULA UNIFLORA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
CARDAMINE DIGITATA	ARCTIC	NORTH AMERICA, ASIA	ZONE 2
CARDAMINE PRATENSIS ANGUSTIFOLIA	ARCTIC	CIRCUMPOLAR	ZONE 2
CAREX AQUATILIS	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
CAREX ATROFUSCA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 4
CAREX BIGELOWII	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 3
CAREX CHORDORRHIZA	ARCTIC	CIRCUMPOLAR	ZONE 4
CAREX KRAUSEI	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 3
CAREX MARINA	COASTAL	CIRCUMPOLAR	ZONE 3
CAREX MARITIMA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
CAREX MEMBRANACEA	ARCTIC	NORTH AMERICA, ASIA	ZONE 3
CAREX MISANDRA MISANDRA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
CAREX RARIFLORA	ARCTIC	CIRCUMPOLAR	ZONE 3
CAREX ROTUNDATA	ARCTIC	CIRCUMPOLAR	ZONE 4
CAREX RUPESTRIS	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
CAREX SAXATILIS LAXA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
CAREX SCIRPOIDEA	ARCTIC - ALPINE	NORTH AMERICA	ZONE 3
CAREX SUBSPATHACEA	COASTAL	CIRCUMPOLAR	ZONE 3
CAREX URSINA	COASTAL	CIRCUMPOLAR	ZONE 1
CAREX VAGINATA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 4
CASSIOPE TETRAGONA TETRAGONA	ARCTIC	CIRCUMPOLAR	ZONE 2
CASTILLEJA CAUDATA	ARCTIC	NORTH AMERICA, ASIA	ZONE 3
CERASTIUM BEERINGIANUM BEERINGIANUM	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 2
CERASTIUM BEERINGIANUM GRANDIFLORUM	ARCTIC	NORTH AMERICA, ASIA	ZONE 3
CERASTIUM JENISEJENSE	ARCTIC	NORTH AMERICA, ASIA	ZONE 2
CHRYSANTHEMUM BIPINNATUM BIPINNATUM	ARCTIC	NORTH AMERICA, ASIA	ZONE 3
CHRYSANTHEMUM INTEGRIFOLIUM	ARCTIC	NORTH AMERICA	ZONE 3
CHRYSOSPLENIUM TETRANDRUM	ARCTIC	CIRCUMPOLAR	ZONE 2
COCHLEARIA OFFICINALIS ARCTICA	COASTAL	CIRCUMPOLAR	ZONE 2
COLPODIUM VAHLIANUM	ARCTIC	CIRCUMPOLAR	ZONE 2
DESCHAMPSIA CAESPITOSA ORIENTALIS	ARCTIC	NORTH AMERICA, ASIA	ZONE 2
DESCURIANIA SOPHIOIDES	ARCTIC	CIRCUMPOLAR	ZONE 3
DODECATHEON FRIGIDUM	ARCTIC	NORTH WEST AMERICA	ZONE 3
DRABA ALPINA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 1
DRABA BOREALIS	COASTAL	NORTH AMERICA, ASIA	ZONE 4
DRABA CINEREA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 3
DRABA CORYMBOSA	ARCTIC	CIRCUMPOLAR	ZONE 1
DRABA GLABELLA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 3
DRABA LACTEA	ARCTIC	CIRCUMPOLAR	ZONE 2
DRABA LONGIPES	ARCTIC	NORTH WEST AMERICA	ZONE 3
DRYAS INTEGRIFOLIA INTEGRIFOLIA	ARCTIC - ALPINE	NORTH AMERICA	ZONE 1
DUPONTIA FISHERI	COASTAL	CIRCUMPOLAR	ZONE 1

Table D1 (cont'd). Floristic classifications for the vascular flora.

SPECIES NAME	PHYSIOGRAPHIC UNIT	GEOGRAPHIC RANGE	NORTHERN [illegible] YOUNG'S ZONES
ELYMUS ARENARIUS MOLLIS VILLOSISSIMUS	ARCTIC	NORTH AMERICA, ASIA	ZONE 3
EPILOPIUM DAVURICUM ARCTICUM	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 4
EPILOBIUM LATIFOLIUM	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
EQUISETUM ARVENSE	ARCTIC - BOREAL	CIRCUMPOLAR	ZONE 2
EQUISETUM SCIRPOIDES	ARCTIC - BOREAL	CIRCUMPOLAR	ZONE 3
EQUISETUM VARIEGATUM	ARCTIC - BOREAL	CIRCUMPOLAR	ZONE 2
ERIGERON ERIOCEPHALUS	ARCTIC	CIRCUMPOLAR	ZONE 2
ERIGERON HUMILIS	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 3
ERIGERON HYPERBOREUS	ARCTIC - ALPINE	NORTH WEST AMERICA	ZONE 4
ERIOPHORUM ANGUSTIFOLIUM SUBARCTICUM	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
ERIOPHORUM CALLITRIX	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 3
ERIOPHORUM RUSSEOLUM	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 3
ERIOPHORUM SCHEUCHZERI SCHEUCHZERI	ARCTIC	CIRCUMPOLAR	ZONE 2
ERIOPHORUM TRISTE	ARCTIC	CIRCUMPOLAR	ZONE 1
ERIOPHORUM VAGINATUM	ARCTIC - BOREAL	CIRCUMPOLAR	ZONE 3
ERITRICHUM ARETIOIDES	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 2
ERYSIMUM PALLASSII	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
EUTREMA EDWARDSII	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
FESTUCA BAFFINENSIS	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 1
FESTUCA BRACHYPHYLLA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
FESTUCA OVINA ALASKENSIS	ARCTIC - ALPINE	NORTH WEST AMERICA	ZONE 4
FESTUCA RUBRA	ARCTIC - BOREAL	CIRCUMPOLAR	ZONE 3
GENTIANA PROSTRATA	ARCTIC - ALPINE	W NORTH AMERICA, ASIA, EUROPE	ZONE 4
GENTIANELLA PROPINQUA PROPINQUA	ARCTIC - ALPINE	NORTH AMERICA	ZONE 4
HEDYSARUM ALPINUM AMERICANUM	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 3
HEDYSARUM MACKINZII	ARCTIC - BOREAL	NORTH AMERICA	ZONE 3
HIEROCHLOE ALPINA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
HIEROCHLOE PAUCIFLORA	ARCTIC	NORTH AMERICA, ASIA	ZONE 2
HIPPURIS TETRAPYLLA	COASTAL	CIRCUMPOLAR	ZONE 3
HIPPURIS VULGARIS	ARCTIC - BOREAL	CIRCUMPOLAR	ZONE 3
HONCKENYA PEPLOIDES PEPLOIDES	COASTAL	CIRCUMPOLAR	ZONE 3
JUNCUS ARCTICUS ALASKANUS	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 3
JUNCUS BIGLUMIS	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 1
JUNCUS CASTANEUS CASTANEUS	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 3
JUNCUS CASTANEUS LEUCOCHLAMYS	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 3
JUNCUS TRIGLUMIS ALBESCENS	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 3
KOBRESIA MYOSUROIDES	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
KOBRESIA SIBIRICA	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 3
KOENIGIA ISLANDICA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 3
LAGOTIS GLAUCA MINOR	ARCTIC	NORTH AMERICA, ASIA	ZONE 3
LEDUM PALUSTRE DECUMBENS	ARCTIC - BOREAL	NORTH AMERICA, ASIA	ZONE 3
LESQUERELLA ARCTICA ARCTICA	ARCTIC	NORTH AMERICA	ZONE 2
LLOYDIA SEROTINA	ARCTIC - ALPINE	W NORTH AMERICA, ASIA, EUROPE	ZONE 2
LUPINUS ARCTICUS	ARCTIC	NORTH AMERICA	ZONE 3
LUZULA ARCTICA	ARCTIC	CIRCUMPOLAR	ZONE 1
LUZULA CONFUSA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 1
LUZULA KJELLMANIANA	ARCTIC	NORTH AMERICA, ASIA	ZONE 2
LUZULA MULTIFLORA	ARCTIC - BOREAL	CIRCUMPOLAR	ZONE 4
LYCOPODIUM SELAGO APPRESSUM	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
MERTENSIA MARITIMA MARITIMA	COASTAL	EASTERN NORTH AMERICA	ZONE 2
MINUARTIA ARCTICA	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 3
MINUARTIA ROSSII	ARCTIC - ALPINE	NORTH AMERICA	ZONE 2
MINUARTIA RUBELLA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 1
ORTHILIA SECUNDATA OBTUSATA	ARCTIC - BOREAL	CIRCUMPOLAR	ZONE 4
OXYRIA DIGYNA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 1
OXYTROPIS ARCTICA	ARCTIC	NORTH AMERICA, ASIA	ZONE 2
OXYTROPIS BOREALIS	ARCTIC	NORTH AMERICA, ASIA	ZONE 3
OXYTROPIS CAMPESTRIS GRACILIS	ARCTIC - ALPINE	NORTH AMERICA	ZONE 3
OXYTROPIS CAMPESTRIS JORDALLI	ARCTIC - ALPINE	NORTH WEST AMERICA	ZONE 3
OXYTROPIS DEFLEXA FOLIOLOSA	ARCTIC - ALPINE	NORTH AMERICA	ZONE 3
OXYTROPIS MAYDELLIANA	ARCTIC	NORTH AMERICA, ASIA	ZONE 3
OXYTROPIS NIGRESCENS BRYOPHILA	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 2
PAPAVER LAPPONICUM OCCIDENTALE	ARCTIC	CIRCUMPOLAR	ZONE 1
PAPAVER MACOUNII	ARCTIC	NORTH AMERICA, ASIA	ZONE 2
PARNASSIA KOTZEBUEI	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 3
PARRYA NUDICAULIS NUDICAULIS	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 2
PARRYA NUDICAULIS SEPTENTRIONALIS	ARCTIC	NORTH AMERICA, ASIA	ZONE 3
PEDICULARIS CAPITATA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
PEDICULARIS HIRSUTA	ARCTIC	EASTERN NORTH AMERICA	ZONE 1
PEDICULARIS LANATA	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 2
PEDICULARIS LANGSDORFFII ARCTICA	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 2
PEDICULARIS SUDETICA ALBOLABIATA	ARCTIC	NORTH AMERICA, ASIA	ZONE 2
PEDICULARIS SUDETICA INTERIOR	ARCTIC - ALPINE	NORTH WEST AMERICA	ZONE 3
PEDICULARIS VERTICILLATA	ARCTIC - ALPINE	W NORTH AMERICA, ASIA, EUROPE	ZONE 3
PETASITES FRIGIDUS	ARCTIC - BOREAL	W NORTH AMERICA, ASIA, EUROPE	ZONE 3
PHIPPSIA ALGIDA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 1
PLEUROPOGON SABINEI	ARCTIC	CIRCUMPOLAR	ZONE 1

Table D1 (cont'd).

SPECIES NAME	PHYSIOGRAPHIC UNIT	GEOGRAPHIC RANGE	NORTHERN LIMIT YOUNG'S ZONES
POA ALPIGENA	ARCTIC	CIRCUMPOLAR	ZONE 1
POA ARCTICA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 1
POS GLAUCA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 3
POA MALACANTHA	ARCTIC	NORTH AMERICA, ASIA	ZONE 2
POA PRATENSIS	ARCTIC - BOREAL	CIRCUMPOLAR	ZONE 4
POLEMONIUM ACUTIFLORUM	ARCTIC - ALPINE	W NORTH AMERICA, ASIA, EUROPE	ZONE 2
POLEMONIUM BOREALE	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
POLYGONUM BISTORTA PLUMOSUM	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 2
POLYGONUM VIVIPARUM	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
POTENTILLA HOOKERIANA HOOKERIANA	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 3
POTENTILLA HYPARCTICA	ARCTIC	CIRCUMPOLAR	ZONE 1
POTENTILLA PALUSTRIS	ARCTIC - BOREAL	NORTH AMERICA, ASIA	ZONE 4
POTENTILLA PULCHELLA	COASTAL	CIRCUMPOLAR	ZONE 2
POTENTILLA UNIFLORA	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 2
PRIMULA BOREALIS	COASTAL	NORTH AMERICA, ASIA	ZONE 2
PUCCINELLIA ANDERSONII	COASTAL	EASTERN NORTH AMERICA	ZONE 2
PUCCINELLIA ANGUSTATA	COASTAL	CIRCUMPOLAR	ZONE 1
PUCCINELLIA PHRYGANODES	COASTAL	CIRCUMPOLAR	ZONE 2
PYROLA GRANDIFLORA	ARCTIC - BOREAL	CIRCUMPOLAR	ZONE 3
RANUNCULUS GMELINI GMELINI	ARCTIC - BOREAL	NORTH AMERICA, ASIA	ZONE 2
RANUNCULUS HYPERBOREUS HYPERBOREUS	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
RANUNCULUS NIVALIS	ARCTIC	CIRCUMPOLAR	ZONE 2
RANUNCULUS PALLASII	ARCTIC	CIRCUMPOLAR	ZONE 2
RANUNCULUS PEDATIFIDUS AFFINIS	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
RANUNCULUS TRICHOPHYLLUS ERADICATUS	ARCTIC - BOREAL	CIRCUMPOLAR	ZONE 3
RUBUS CHAMAEMORUS	ARCTIC - BOREAL	CIRCUMPOLAR	ZONE 3
SAGINA INTERMEDIA	ARCTIC	CIRCUMPOLAR	ZONE 2
SALIX ALAXENSIS ALAXENSIS	ARCTIC	NORTH AMERICA, ASIA	ZONE 3
SALIX ARCTICA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 1
SALIX ARCTOPHILA	ARCTIC	EASTERN NORTH AMERICA	ZONE 2
SALIX BRACHYCARPA NIPHOCLADA	ARCTIC	NORTH WEST AMERICA	ZONE 3
SALIX GLAUCA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 3
SALIX LANATA RICHARDSONII	ARCTIC	CIRCUMPOLAR	ZONE 3
SALIX OVALIFOLIA OVALIFOLIA	COASTAL	NORTH AMERICA, ASIA	ZONE 2
SALIX PHLEBOPHYLLA	ARCTIC	NORTH AMERICA, ASIA	ZONE 2
SALIX PLANIFOLIA PULCHRA PULCHRA	ARCTIC	NORTH AMERICA, ASIA	ZONE 2
SALIX RETICULATA RETICULATA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 3
SALIX ROTUNDIFOLIA ROTUNDIFOLIA	ARCTIC	NORTH WEST AMERICA	ZONE 2
SALIX SPHENOPHYLLA	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 3
SAUSSUREA ANGUSTIFOLIA	ARCTIC	NORTH WEST AMERICA	ZONE 3
SAXIFRAGA BRONCHIALIS FUNSTONII	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 2
SAXIFRAGA CAESPITOSA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 1
SAXIFRAGA CERNUA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 1
SAXIFRAGA FOLIOLOSA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
SAXIFRAGA HIERACIFOLIA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
SAXIFRAGA HIRCULUS PROPINQUA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 1
SAXIFRAGA NELSONIANA	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 2
SAXIFRAGA OPPOSITIFOLIA OPPOSITIFOLIA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 1
SAXIFRAGA RIVULARIS	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 1
SAXIFRAGA TRICUSPIDATA	ARCTIC - ALPINE	NORTH AMERICA	ZONE 2
SEDUM ROSEA INTEGRIFOLIUM	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 3
SENECIO ATROPURPUREUS FRIGIDUS	ARCTIC	NORTH AMERICA, ASIA	ZONE 2
SENECIO CONGESTUS	ARCTIC - BOREAL	CIRCUMPOLAR	ZONE 2
SENECIO HYPERBOREALIS	ARCTIC	NORTH WEST AMERICA	ZONE 3
SENECIO RESEDIFOLIUS	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 3
SILENE ACAULIS	ARCTIC - ALPINE	EASTERN NORTH AMERICA	ZONE 1
SILENE INVOLUCRATA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
SILENE WAHLBERGELLA ARCTICA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
SPARGANIUM HYPERBOREUM	ARCTIC	CIRCUMPOLAR	ZONE 4
STELLARIA EDWARDSII	ARCTIC	CIRCUMPOLAR	ZONE 1
STELLARIA HUMIFUSA	COASTAL	CIRCUMPOLAR	ZONE 2
STELLARIA LAETA	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 1
TARAXACUM CERATOPHORUM	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
TARAXACUM PHYMATOCARPUM	ARCTIC	NORTH AMERICA	ZONE 2
THALICTRUM ALPINUM	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 3
THLASPI ARCTICUM	ARCTIC	NORTH WEST AMERICA	ZONE 3
TOFIELDIA PUSILLA	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 3
TRISETUM SPICATUM	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 2
UTRICULARIA VULGARIS MACRORHIZA	ARCTIC - BOREAL	NORTH AMERICA	ZONE 4
VACCINIUM ULIGINOSUM MICROPHYLLUM	ARCTIC - ALPINE	CIRCUMPOLAR	ZONE 3
VACCINIUM VITIS-IDAEA MINUS	ARCTIC - BOREAL	CIRCUMPOLAR	ZONE 3
VALERIANA CAPITATA	ARCTIC - ALPINE	NORTH AMERICA, ASIA	ZONE 2
WILHELMSIA PHYSODES	ARCTIC	NORTH AMERICA, ASIA	ZONE 3

Table D2. Comparisons between the various floristic units.

I. Physiographic unit by geographic range

	No.	Pct. of physiographic unit	Pct. of Total
Arctic-alpine			
North America	8	7.4	3.6
N. Amer.-Asia	29	26.9	13.0
E. North Amer.	1	.9	.4
Circumpolar	60	55.6	26.9
NW America	4	3.7	1.8
W.N. Amer., Asia, Europe	6	5.6	2.7
	108	100.0	48.4
Arctic			
North America	6	8.1	2.7
N. Amer.-Asia	30	40.5	13.5
E. North Amer.	2	2.7	.9
Circumpolar	28	37.8	12.6
NW America	8	10.8	3.6
W. N. Amer., Asia, Europe	0	0	0
	74	100.0	33.2
Arctic-boreal			
North America	2	8.3	.9
N. Amer.-Asia	4	16.7	1.8
E. North Amer.	0	0	0
Circumpolar	17	70.8	7.6
NW America	0	0	0
W.N. Amer., Asia, Europe	1	4.2	.4
	24	100.0	10.8
Coastal			
North America	0	0	0
N. Amer.-Asia	4	23.5	1.8
E. North Amer.	2	11.8	.9
Circumpolar	11	64.7	4.9
NW America	0	0	0
W.N. Amer., Asia, Europe	0	0	0
	17	100.0	7.6

II. Physiographic unit by northern limit

	No.	Pct. of physiographic unit	Pct. of Total
Arctic-alpine			
Zone 1	7	15.7	7.6
Zone 2	46	42.6	20.6
Zone 3	39	36.1	17.5
Zone 4	6	5.6	2.7
	108	100.0	48.4
Arctic			
Zone 1	11	14.9	4.9
Zone 2	31	41.9	13.9
Zone 3	29	39.2	13.0
Zone 4	3	4.1	1.3
	74	100.0	33.2
Arctic-boreal			
Zone 1	0	0	0
Zone 2	4	16.7	1.8
Zone 3	12	50.0	5.4
Zone 4	8	33.3	3.6
	24	100.0	10.8
Coastal			
Zone 1	3	17.6	1.3
Zone 2	8	47.1	3.6
Zone 3	5	29.6	2.2
Zone 4	1	5.9	.4
	17	100.0	7.6

III. Geographic range by northern limit

	No.	Pct. of Range unit	Pct. of Total
North American			
Zone 1	1	6.3	.4
Zone 2	5	31.3	2.2
Zone 3	8	50.0	3.6
Zone 4	2	12.5	.9
	16	100.0	7.1
N. Amer., Asia			
Zone 1	1	1.5	.4
Zone 2	30	44.8	13.5
Zone 3	33	49.3	14.8
Zone 4	3	4.5	1.3
	67	100.0	30.0
E. North America			
Zone 1	2	40.0	.9
Zone 2	3	60.0	1.3
Zone 3	0	0	0
Zone 4	0	0	0
	5	100.0	2.2
Circumpolar			
Zone 1	27	23.3	12.1
Zone 2	46	39.7	20.6
Zone 3	33	28.4	14.8
Zone 4	10	8.6	4.5
	116	100.0	52.0
NW America			
Zone 1	0	0	0
Zone 2	1	8.3	.4
Zone 3	9	75.0	4.0
Zone 4	2	16.7	.9
	12	100.0	5.3
W.N. Amer., Asia, Eur.			
Zone 1	0	0	0
Zone 2	4	57.1	1.8
Zone 3	2	28.6	.9
Zone 4	1	14.3	.4
	7	100.0	3.1

END

FILMED

1-86

DTIC